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ABSTRACT

In a society that has traditionally emphasized the economic value of a college education, large numbers of college graduates in California are reporting great difficulty in finding employment, particularly during the past few years. The principal purpose of this study was to examine the relationship between projected college educated manpower needs in California and the supply of graduates in selected academic disciplines or fields of study from the state's 4 segments of higher education. Another important purpose of the study was to determine the extent to which projections of college and university graduates in selected occupations are expected to meet the state's manpower needs in terms of surpluses and shortages. The study was also designed to identify major state agencies and educational institutions within California that are charged with significant roles in manpower planning and development, a description of those roles and functions, and to determine their interrelationships. (HS)

CALIFORNIA SUPPLY AND DEMAND FOR COLLEGE EDUCATED MANPOWER IN SELECTED OCCUPATIONS

John F. O'Toole, Jr.
Perry E. Rosove

A Report Prepared
for the

Select Committee on the
Master Plan for Higher Education

June, 1972

COORDINATING COUNCIL FOR HIGHER EDUCATION
STATE OF CALIFORNIA, SACRAMENTO CALIFORNIA

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July, 1972

THE COORDINATING COUNCIL FOR HIGHER EDUCATION
FOR CALIFORNIA

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FOREWORD

There is probably no greater waste of human resources than the lack of opportunity for college graduates to apply the skills and problem solving abilities that have been encouraged by public policy and carefully nurtured in institutions of higher learning. Yet, at both national and state levels, despite commendable commitments to higher education, the lack of policy and appropriate planning for effective utilization of college educated manpower have produced a surplus of graduates equipped for professional careers in teaching, engineering, chemistry, and other fields. This condition is made worse by a social need for the skills of these highly trained professionals in occupations where manpower imbalances presently exist and are projected for the years ahead. It is equally costly when shortages occur in other career fields such as the health sciences.

In higher education and state government serious concern has recently been expressed about this ill-fitting relationship between job-market demand and the supply of college educated manpower. Institutions of higher education and state governments have been inclined to reduce funding and academic programs in career fields in which a surplus presently exists or is projected in the future. Some of these adjustments have been based on short term indicators; others have been purely arbitrary and almost intuitive, without the benefit of reliable data, the use of sound methodology, or consideration of available alternatives. In broader areas, universities, state coordination and planning agencies, professional associations and national study commissions have advised, and, in some cases, mandated a moratorium on expanded or new Ph.D. programs because of a projected "oversupply" of 200,000 Ph.D.'s during 1980-84.

The California Select Committee on the Master Plan for Higher Education considered the problem of supply and demand for college educated manpower to be a key area of concern in its review of planning for the years ahead. The Subcommittee on Cost/Benefit and Finance of the Select Committee determined that planning for effective utilization of college educated manpower must include first, an inquiry into present forecasting methods by which manpower needs and supply projections are made in the State, and second, the identification of acceptable alternatives for effecting a better linkage between supply and demand.

These determinations led the Executive Director of the Select Committee to design a manpower study that would emphasize the forecasting methods that are currently utilized in California to project college manpower needs and supply and to influence students' choice of careers. As Principal Investigator for the study, we were fortunate in securing the able services of Dr. John F. O'Toole, Jr., formerly the Director and General Manager of Computer Sciences Institute, the education and training division of Computer Sciences Corporation, a Los Angeles firm. Dr. O'Toole, a professional educator

nd an outstanding researcher, who is also highly experienced in systems analysis and management, devoted full-time to the study in order to ensure its timely completion. Dr. Perry E. Rosove, a former associate of Dr. O'Toole at Computer Sciences Institute, where he was Senior Member of the Technical Staff, served as Co-Investigator. Dr. Rosove, also an educator, has extensive experience in systems research and development and forecasting methods, and is the editor and major contributor to *Developing Computer-Based Information Systems*, published by John Wiley and Sons.

Dr. O'Toole and his colleague have probably gathered and analyzed more manpower data in California than anyone before. They have done so in a remarkably short period of time, considering the broad scope of their study and the magnitude of the effort it involved. Their thorough supply and demand analyses of selected occupations and discussion of the manpower policy and planning issues they raise for California and its institutions of higher education represent a significant contribution to more effective statewide systems planning of higher education in the State. I feel confident that this manpower study will prove very helpful to the Select Committee on the Master Plan and other groups which are interested in the subject. We are indebted to Dr. O'Toole and his associate, Dr. Rosove, for their excellent work.

The members of the Select Committee's Subcommittee on Cost/Benefit and Finance, Burnham Enerson, Ivan Hinderaker, Paul Lawrence, Gordon Marshall, Roger Pettitt (chairman), and Gordon Paul Smith had the foresight to request the study for use in their assignment and for wider use by others involved in State policy.

The study was recommended by the Select Committee on the Master Plan and commissioned by the California Coordinating Council for Higher Education. It was financed through funds secured from the United States Department of Housing and Urban Development and through the efforts of the Office of Planning and Research of the Governor's office. Dr. Owen Albert Knorr, Director of the Coordinating Council, encouraged the study and with Dr. Kenneth O'Brien, Associate Director of the Coordinating Council, helped us wind our way through labyrinthian channels of bureaucracy. Hopefully, this report will enable policy makers to improve statewide planning for development and utilization of human resources, particularly in California's institutions of higher education.

Durward Long
Executive Director
Select Committee on the Master Plan
and
Associate Director
California Coordinating Council
for Higher Education

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SECTION I

INTRODUCTION

Background of the Study

In a society which has traditionally emphasized the economic value of a college education, large numbers of college graduates in California are reporting great difficulty in finding employment, particularly during the past few years. The economic recession at national and state levels, is, of course, a factor. But manpower planners, educators, and experienced economists believe there are more fundamental reasons to account for supply and demand imbalances among college graduates. The consensus seems to be that colleges and universities are simply turning out far more graduates than can be absorbed in the labor market. Thus, even when the economy improves, the job outlook for college educated manpower may not brighten significantly. If present trends continue, unemployment or at least underemployment among highly trained young people could develop into a serious social problem of national importance.

Do we have a problem in California? If so, how serious is it and how long will it last? If supply and demand imbalances do, in fact, exist for college educated manpower in California, what action should be taken? Answers to these questions and the manpower policy issues they raise were of considerable interest to the Select Committee on the Master Plan for Higher Education. The Committee was appointed by the California Coordinating Council for Higher Education in May, 1971 to reconsider and update the 1960 Master Plan. The Committee's charge was "to examine the policies and issues of the Master Plan of 1960 in light of new circumstances, developments, and the needs of higher education in the 1970's."

Since an evaluation of the relationship between college educated manpower supply and demand in the State appeared to be of significant importance and a necessary component of its review of the Master Plan for the 1970's, the Select Committee requested that such a study be accomplished as an added task within the larger framework of its charge by the Coordinating Council. The Committee felt that the results of such a study would enhance its other Master Plan study activities since an understanding of manpower problems and issues within the State of California should enable the Coordinating Council to achieve more effective educational system planning and coordination among the segments of higher education. The results of the study would also have a beneficial effect on present and planned academic programs, collegiate counseling needs, and the planning of additional physical facilities for public higher education.

In response to the Committee's request and in accordance with the terms of a subsequent contractual agreement with the Coordinating Council for Higher Education, dated February 15, 1972, the present study was added to the scope of the Select Committee's charge and was conducted under the overall direction of Dr. Durward Long, Executive Director of the Select Committee.

Purpose of the Study

The principal purpose of the study was to examine the relationship between projected college educated manpower needs in California and the supply of graduates in selected academic disciplines or fields of study from the State's four segments of higher education. Underlying this fundamental objective was the requirement to provide a better understanding of manpower problems and policy issues as they are related to supply and demand analyses and the planning and coordination of higher education in California during the 1970's.

Another important purpose of the study was to determine the extent to which projections of college and university graduates in selected occupations are expected to meet the State's manpower needs in terms of surpluses and shortages. The study was also designed to identify major State agencies and educational institutions within California which are charged with significant roles in manpower planning and development, a description of those roles and functions, and to determine their interrelationships.

An attempt was also made to determine the nature and extent of statewide manpower planning problems in higher education as a result of the supply and demand analyses of selected occupations, to provide conclusions and recommendations concerning such problems, and to suggest additional manpower research needs.

Limitations of the Study

In a study of this scope and magnitude, the time factor imposed a considerable constraint upon the completion of the objectives we hoped to achieve. Because of time limitations and certain statistical, methodological, and data collection problems, we found it necessary to limit to six the number of occupations selected for supply and demand analysis. However, in retrospect, the selection of six occupational fields did not, we feel, result in a study limitation. Fortunately, we were able to derive manpower supply and demand problems and significant issues they raise from the six occupations in a very adequate manner. Even if we had studied ten or more academic fields, we do not feel that the results of the study would have been qualitatively different. The time factor was, however, limiting in terms of the depth and treatment we were able to devote to any one issue or occupation. It also served to reduce the number of interviews conducted, and did not permit us to analyze in detail the various interrelationships which exist among the State's manpower planning and development agencies.

The statistical, methodological, and data collection problems we encountered are detailed later in this and subsequent sections of the report and will not be described in detail here. There are other limitations, however, which deserve mention since they affected the results obtained. First, a serious limitation was placed on the study by the fact that two of the four segments of higher education are not statewide systems and therefore could not provide us with

necessary enrollment and statistical data on degrees, academic majors, and other relevant manpower information. The Association of Independent California Colleges and Universities (AICCU) and the California Community Colleges participated in the data collection activities to the extent possible, but because they lack manpower resources and data collection capabilities for statewide reporting, they could not provide the necessary data without special surveys of their member institutions.

Second, for several reasons, job demand data in California for college educated manpower were inadequate for our needs. The only official job-market information we could obtain was in *California's Manpower Needs to 1975,* a publication of the California Department of Human Resources Development (HRD), published in October, 1969. This document was found to have many limitations, particularly in its economic growth assumptions (See section II of this report), and therefore its projections of job demands were considered unreliable. The report also was limited in the time span covered in its projections. Our study was designed to compare the supply and demand of college educated manpower during the 1970-1980 time period, for purposes of the Master Plan review by the Select Committee. Unfortunately, since the HRD analysis only extended from 1968 through 1975, all of our supply data had to be compared within that time period rather than from 1970-1980. In many cases however, in analyzing the estimated supply and demand data in selected occupations, we were able to project our estimates beyond 1975, especially where we were able to identify distinct trends.

Finally, we were forced to ignore such important supply and demand variables as occupational mobility, in-migration and out-migration in California, occupational attrition rates, standard manpower-population ratios, and other demographic factors. This was partly because of the time constraints imposed on the study and partly because such data were unavailable.

The results of our study therefore represent an impressionistic interpretation of supply and demand relationships among college graduates in California, which are supported by quantitative data from a variety of sources. It is not, therefore, a definitive manpower study and is not represented as such. But we feel confident that the outcomes of the study, despite its inherent limitations, raise some important manpower policy issues which deserve attention and serious consideration by the Select Committee on the Master Plan for Higher Education in California.

Criteria for the Selection of Occupations

Due to the limitations inherent in this report, as described above, it was necessary to select the occupations for study with care. Several criteria were used in their selection. Since only a small number of occupations could be studied in the time available, the selection had to cover a broad spectrum of types of occupations from the physical sciences on the one hand to the liberal arts on the other,

and from the professions requiring postgraduate work to fields normally requiring only a baccalaureate degree. It was thought important to include in our selection occupations that were significant in California in terms of such factors as type of industry (e.g., aerospace and defense industries), known manpower supply and demand imbalances (e.g., teaching), or high educational cost (professional fields). An important criterion in the selection of fields for study was the availability of information, such as unemployment rates and national as well as State data on trends in enrollment and degree production. It was also believed important to include in our sample of occupations those that might reflect changing patterns of enrollment, degree production, and employment or unemployment for women; changing patterns of student interests, such as an interest in working with people or with environmental or ecological problems; or that might bring out possible inconsistencies between student interest and job-market demand. Also important in our selection criteria were occupations that might show the influence of the Federal government on supply and demand imbalances, or on the relationship between social needs and job-market demand.

Based on these wide-ranging criteria, we selected six occupations for study - engineering, chemistry, law, teaching, social work, and the fine arts. We feel that these fields represent a sample which, although small in number, serve to bring out the major types of problems and policy issues that educational planners must resolve in the years ahead.

Study Methods

In order to compare the supply of graduates in the six occupations that were selected for this study with the job-market demand for graduates during the period from 1968 to 1975 and up to 1980 wherever possible, three major steps were required.

The first step was gathering statistical data on both the supply of degrees and job-market demand for the given period of time. The second step was to determine the supply trends for the period of time for which data were available (academic years 1967-68 to 1970-71) and then to project those trends for the period of time for which no supply data were available (academic years 1971-72 to 1974-75 and, in some cases, to 1980). The third step was to compare supply totals based on actual, estimated, and projected numbers of graduates in the selected occupations with estimates of job demand in those fields.

Data Collection

Three methods were used to collect the needed graduate supply data. These methods included: (1) interviewing appropriate personnel representing the educational segments of higher education in California with emphasis on those organizations responsible for research and/or data collection on enrollments and degrees awarded; (2) reviewing the literature on manpower supply and demand studies for California and at the national level with emphasis on those studies dealing with the

six selected occupations and manpower problems and issues in higher education; and (3) requesting specific data from the University of California, the California State University and Colleges, the Association of Independent California Colleges and Universities, and the California Community Colleges on enrollments - undergraduate and graduate - and on degrees - baccalaureate, Master's, First Professional, and Ph.D. - in the selected occupations for academic years 1967-68 through 1971-72. (None of the segments was able to supply the requested data for 1971-72 with the exception of the State University and Colleges which provided enrollment data for that academic year.)

Determination of Supply Trends

Supply trends were determined based on the degree data provided by the segments as noted above. Since the Association of Independent California Colleges and Universities only provided degree data for 1969-70 and 1970-71 and the California Community Colleges could not provide degree data after academic year 1968-69, it was necessary to estimate the number of degrees awarded during the missing academic years by using the degree data that were provided by these two segments in conjunction with the degree data provided for all four academic years by the other two segments. Since trends based on actual degrees awarded varied among the segments depending on the specific field, a variety of methods were used to estimate the missing degree data. The methods used are described in detail in section V. In some cases, due to the paucity of California data on the supply variable, it was necessary to use national data.

Projections of Supply Trends

Supply projections for the period from academic year 1971-72 to 1974-75 were constructed based on enrollment data that were available for academic years 1968-69 to 1971-72, allowing for four-year academic programs. Since equivalent enrollment data for the selected occupations were not provided by the segments, it was necessary to estimate enrollments for academic years where either no data were provided by the segments or where gaps existed by using enrollment trend information from a variety of sources such as newspaper and journal articles.

Total degree supply in the selected occupations was determined by adding actual and estimated degrees for the 1967-68 to 1970-71 period to the projected degree supply (based on actual and estimated enrollments for academic years 1968-69 to 1971-72) for academic years 1971-72 to 1974-75.

Determination of Manpower Imbalances

Manpower surpluses or shortages were determined by comparing the actual, estimated, and projected degree supply, as described above, with the estimated demand in the selected occupations for the period from 1968 to 1975, as identified in *California Manpower Needs to 1975*, published by the California Department of Human Resources Development in October, 1969. Qualifications associated with the use of this

document for estimating projected manpower imbalances are noted in section V.

Organization of the Study

This report is organized into seven sections in addition to this Introduction. The major part of the report is section V, "Supply and Demand in Selected Occupations and Other Manpower Development Programs," which contains the analyses of supply and demand in the six selected occupations and descriptions of several manpower development programs in the State. Section II, "Manpower Data Collection," deals with the problems that were encountered in conducting the data collection for the analyses of enrollment and degree trends. Section III, "Methodological Problems in Supply and Demand Studies," was written as a result of our review of many reports, journal articles, and books dealing with manpower supply and demand. Section IV, "A Systems Approach to Educational Planning," was written at the request of Dr. Durward Long who felt that the authors' experience and background in the systems field would provide a useful viewpoint of educational planning. Section VI, "Major Issues in Educational Planning," reviews six issues that appeared to us to be most important for educational planning as a result of our literature review, data collection activities, and analyses of manpower supply and demand. The title of Section VII, "Conclusions and Recommendations," is self-explanatory. Section VIII is a bibliography of significant reports, journal articles, and books dealing with the subject matter of this report.

SECTION II

MANPOWER DATA COLLECTION

Introduction

The term "data" is commonly used to refer to a variety of numerical facts or statistics, e.g., demographic information relating to population or birth rates, state net migration percentages, employment and unemployment rates, and other economic variables such as the rate of industrial expansion, business forecasts, and, in the present manpower study, supply and demand estimates and projections.

However, in this section and throughout the report, when we refer to "data collection," we are using the term "data" in a much broader sense. It includes not only statistical data but non-statistical information obtained from books, magazines, periodicals, education journals, newspapers, and government and privately sponsored manpower research studies and reports. The term also comprises interview data provided by a variety of California government officials, educators, manpower specialists, California state legislators, other consultants and researchers, and representatives of several professional associations in the State of California.

Ordinarily, we would not have chosen "data collection" as a separate section in a manpower study of this kind. However, since the identification and acquisition of both statistical and non-statistical information represented such an essential, substantive element of the present study, and most importantly, because of the difficulties and problems we encountered in obtaining the necessary data, we have included it for emphasis since we believe these problems should be brought to the attention of the Select Committee because we consider them to be at least as important as the results of the supply and demand analyses of selected occupations.

Objectives

In conducting a more typical manpower study than this one, we would have generated original statistical data and estimates of future supply and demand in the occupations we have selected for analyses, using demographic and other economic variables. However, because of the broad scope of this study and the limited time available, of necessity, we relied for the most part on collecting and reviewing published data rather than deriving our own, since there were many studies available. A large number and variety of federal and state government sources were used for these kinds of data, as well as the four California segments of higher education, as described in a later section.

As reference material, we also made extensive use of the manpower research reports of private consultants, national manpower specialists, higher education association, and professional groups such as the National Education Association, the California Bar Association, the American Chemical Society, and the National Science Foundation for both statistical and non-statistical information. The principal

objectives of our data collection activities were to: (1) identify, locate, acquire, review and compare available national and California manpower literature and studies of current and projected supply and demand in selected occupations during the 1970's, (2) collect the statistical data relating to current and projected supply from each of the four segments of higher education, (3) by means of interviews, determine possible manpower problems and policy issues from California data sources, e.g., institutions of higher education, government agencies, state legislators and other manpower researchers, and (4) identify and describe the independent functions of and the inter-relationships that exist among major California manpower agencies, educational institutions, and other organizations within the State that are charged with significant roles in manpower development and planning.

Sources and Types of Data

The bibliography in this report provides a comprehensive listing of all the documents which were used as background information. It does not identify the large number of different federal and state government agencies, research groups, commissions, educational institutions, professional associations, and other organizations which contributed significantly to the volume of manpower data collected for our purposes. The following outline of these sources of data and the types of information they provided should help to delineate the nature and scope of our data collection activities.

Federal Government Agencies

U.S. Department of Labor: Bureau of Labor Statistics, Manpower Administration, Office of Research and Development, and the Office of Manpower and Employment Statistics
U.S. Department of Health, Education and Welfare: U.S. Office of Education, National Center for Educational Statistics
U.S. Department of Commerce, Bureau of the Census
Superintendent of Documents, U.S. Government Printing Office

These agencies provided official government-sponsored manpower studies and supply and demand forecasts for a large number of occupations, statistical data on population, economic growth rate, unemployment data and other demographic information. The focus of all these reports and studies was on national manpower forecasts of supply and demand for a large number of occupations requiring college training during the 1970-1980 time period.

National Professional Associations, Commissions and Educational Organizations

American Bar Association
American Council on Education
National Research Council, National Academy of Sciences
Scientific Manpower Commission
National Science Foundation

American Association for the Advancement of Science
National Manpower Policy Task Force
National Education Association Task Force on the Underutilization of Teachers and Other College Trained Personnel
National Education Association, Research Division
American Association of State Colleges and Universities
Carnegie Commission on Higher Education
National Planning Association
Educational Policy Research Center, Syracuse University Research Corporation

These professional associations, research organizations and educational groups provided valuable manpower studies, additional references, bulletins and periodicals related to current and projected manpower problems and issues in specialized fields, e.g., engineering and other scientific personnel, education and professional and graduate education. The focus here again was at the national level.

Government Agencies, Professional Associations, and Manpower Organizations in California

Department of Finance: Office of the Director, Population Research Division, and the Budget Division
Department of Education, Bureau of School District Organization and Administrative Research
Commission for Teacher Preparation and Licensing, State of California
Department of Industrial Relations, Division of Apprenticeship Standards
Department of Human Resources Development: Office of Research and Statistics, Office of the Assistant Director for Program Services, and Office of the Director, Education and Training Liaison (Job Training, Development, and Placement Division)
Assembly, California Legislature, Select Committee on Manpower Development; Assembly Office of Research
California Manpower Coordinating Committee
California State Bar, Board of Governors
California State Bar Examiners

These departments and legislative groups in the state government of California and manpower development and research agencies provided not only California statistical data for supply and demand analyses of selected occupations, but extremely valuable interview information and available research studies related to manpower problems and policy issues in California during the 1970's. The interviews also were helpful to us in developing better insights and understandings of some of the functions of and the interrelationships that exist among various state agencies as they interact with each other and with segments of post-secondary institutions of higher education in California.

California Institutions of Higher Education, Commercial Research Organizations, and Consultants

University of California, Office of Analytical Studies, Vice President for Planning
California State University and Colleges, Dean, Institutional Research, Office of the Chancellor
California Community Colleges, Office of the Vice Chancellor
Association of Independent California Colleges and Universities, Office of the Executive Director
Graduate School of Management, University of California, Los Angeles
Manpower Research Center, School of Industrial Relations, University of California, Los Angeles
Graduate School of Education, Division of Vocational Education, University of California, Los Angeles
School of Law, Office of the Dean, University of California, Los Angeles
Claremont Graduate School
Graduate School of Education, Stanford University
Los Angeles Community College District, Office of the Assistant Superintendent of Instruction
Bank of America, Wells Fargo Bank, and Security Pacific National Bank (Economic Research Departments)
California Chamber of Commerce

The four segments of higher education in California provided most of the historical degree production or supply data covering the academic years from 1967-1968 through 1969-1970 for the selected occupations. Data for the current 1971-1972 academic year were unavailable from any of the segments. The segments also provided total undergraduate and graduate enrollment data for the same 1967-1968 through 1969-1970 years, but in most cases were unable to provide undergraduate and graduate enrollment information for specific academic disciplines or fields of study, e.g., engineering, law, education, and the other occupations.

In most cases, enrollment data for specific fields or disciplines were derived from other sources. For example, in law, enrollment in all California law schools was obtained from the California State Bar Examiners; in engineering, freshman enrollment data were obtained from a special research report of a California Assembly Committee related to aerospace and defense industry unemployment. In education, the historical supply data for new elementary and secondary school teachers in California were obtained from the National Education Association's prior annual reports of teacher supply and demand (1967-1970).

The economic research departments of several leading California banks and the Chamber of Commerce contributed valuable data related to California's current and forecasted economy during the 1970's, business prospects, and population growth data. The other listed institutions of higher education, and particularly the consultants

from these colleges and universities, shared their own original manpower research studies with us, recommended additional references, and offered many helpful statistical suggestions and approaches to our supply and demand analyses. Finally, the Los Angeles Community College District's staff personnel were also most helpful in gathering special survey data from their eight colleges regarding total enrollment, trends in occupational and transfer programs, and degree data.

Major Data Collection Problems

Throughout the course of this study, many technical problems were encountered; some were statistical in nature, others involved the time lags normally experienced and anticipated when obtaining documents from the Federal government and other large organizations and research groups. But by far the most serious problems were those related to data collection, particularly from State of California sources, since they directly affected the successful accomplishment of our specified study objectives within the required time limits.

A listing and brief discussion of these problems follow:

1. Complete statewide "system" data needed for supply and demand analyses of selected occupations, e.g., chemistry, law, engineering, etc., were not available from the central offices of two of the segments. The Association of Independent California Colleges and Universities (AICCU), representing 52 of the 77 private colleges and institutions in California, was unable to provide complete data for academic years 1967-1968 through 1970-71. We received 1969-1970 and 1970-1971 data from the AICCU and this was a serious limitation since the missing two years of data for the 52 independent colleges and universities were calculated by using trend data obtained from either the California State University and Colleges segments, or the University of California.

   Technically, this is not a statistically valid procedure, but since the data were unavailable, there was little choice and the results of our estimates do appear reasonable. The remaining 25 private institutions, non-members of the AICCU, were not of course represented in our analyses since data from those colleges and universities were unavailable from any central source, and time did not permit a special survey of individual institutions.

   The AICCU and the California Community College segments were unable to provide the necessary data since they lack the necessary manpower resources to conduct special surveys of their individual institutions, and since they are not statewide "systems", in the same sense as the University of California and the California State University and College systems, they lack statewide data collection resources and therefore do not receive standardized enrollment and degree

data on a regular statewide basis. The Community Colleges, in particular, because they are locally supported and controlled, represent a special and serious "system" problem since a variety of different types of data from their 94 colleges go directly to their respective 68 local school districts, rather than to the central office of the Chancellor of the California Community Colleges. We will address this problem more directly in a later section of this report.

2. All four segments of higher education in California were unable to provide either rough estimates or projections of degrees to be granted during either this academic year, 1971-72, or for the next several years. Further, estimates of future enrollment data were also not available for the specific occupational fields chosen for supply and demand analysis. This was also a disappointment. Since we were using trend analysis as a statistical method during this study, we believe the missing data for this year as well as the next few years might have been quite revealing. Student "crossovers" to other majors, graduate and professional fields, and perhaps even trend changes in degree attainment might have been detected this year and during the next few years.

3. The major source documents dealing with job "demand" in California, such as the California Department of Human Resources Development's, *California Manpower Needs to 1975*,[1] and the Staff Report of the Commission on Human Resources and Advanced Education, *Human Resources and Higher Education*,[2] were based on pre-1969 assumptions, in other words, before the beginning of the 1969-1971 economic recession in the nation, and particularly in Calfiornia. Therefore, the job-market "demand" statistics for California were computed by using national assumptions and data produced by the U.S. Department of Labor, Bureau of Labor Statistics.

   This set of assumptions projected continued economic growth and an unemployment rate of 4.5 percent in California, far less than the actual average annual rate of 6 to 7 percent experienced during the last two years in certain California occupations involving the aerospace and defense industries.

   The California Human Resources Development's projections also estimated continued growth in research and development (R & D) expenditures. Of course, these estimates have proven to be inaccurate, and therefore job-market demands for most of the 150 occupational categories are higher than the actual situation. The technique used was essentially the one described in the 1967 draft of the Bureau of Labor Statistics' publication, *Tommorrow's Manpower Needs*,[3] where estimates of total jobs use national matrics for both the 1960 base period and the 1975 target date. A special State of California matrix was not considered necessary and was therefore not

used, probably accounting for the inaccuracy in California job demand data. Demand for each of the occupational categories was computed by applying national industry-occupation ratios and change factors (percent change over the fifteen-year period) to the appropriate California employment-by-industry estimates.

4. The California "demand" data is quite poor. Most information concerns job applicants for occupations requiring less than a baccalaureate degree. The Human Resources Development (HRD) publication is the only government report that addresses the problem of college and university graduates and other highly educated manpower in the State. We therefore used available national studies and forecasts for the demand and supply analyses we have conducted of selected occupations in California, particularly from 1975-1980.

5. The statistical problem in defining graduate education job requirements is also significant. We evidently do not yet have a clear definition from employers about the standards for graduate work in many professions. Much of the literature we examined on occupational requirements specified for which occupation the baccalaureate degree was required, but seldom was attention given to the requirements, if any, for advanced degree job applicants. There were exceptions, of course, such as physicians, dentists, and teachers. But rarely did we find job requirements for the graduate degree holder mentioned more precisely than "desirable;" very rarely were the entry-level requirements listed as "necessary."

6. In most cases, "demand" data could not easily be compared with "supply" or degree production data since the listed job title had no apparent relationship to degrees in various fields of study or academic disciplines. For example, in the HRD publication, *California Manpower Needs to 1975,* the projected job opportunities are listed by Department of Labor occupational job titles and many of them have no apparent or stated relationship to degrees. Therefore, one can only speculate whether these jobs could be filled by non-degree holders, a bachelor's degree applicant, or a holder of an advanced degree. This is one of the reasons why in this study we have aggregated all degrees in our supply and demand analyses since we assumed employers would consider all degree holders to be prospective employees, regardless of the level of degree attained.

7. As Sultan found in his manpower study, it is difficult to match the academic labels attached to various student enrollment in graduate programs to the major occupational labels for relevant professions.[4] For example, the "Social Science" category is described as one involving some twenty-one graduate activities. These are distinguished from a separate category of "education." But a substantial portion of those

involved in academic majors such as foreign languages, linguistics, political science, psychology and economics clearly have career targets in education, or teaching. Indeed the California Education Code now requires teachers to have a subject matter specialty other than "education." This further complicates the problem of identifying the career objectives for those majoring in the broad social science category.

8. The published sources we collected and examined on both supply and demand were based on different types of assumptions so that the conclusions were frequently in conflict or inconsistent. For example, studies which predicted an oversupply of highly educated manpower in the 1970-1980 time period were based on past relationships between degrees and occupations. Other studies reached different conclusions, based on anticipated future breakthroughs in scientific fields or other technologies.

9. In many cases, the degree and academic discipline categories used in key source documents, such as the annual "Statistical Abstract," published by the Office of Institutional Research, California State University and Colleges, and the annual "Statistical Summary," published by the University of California's Office of Analytical Studies, are not consistent and therefore cannot easily be aggregated as a basis for determining the total number of degrees produced by all segments of higher education. Examples are fine arts, biological sciences, social work (social welfare) and others.

   In fine arts, there does not seem to be a common definition of the field. In the HRD publication, *California Manpower Needs to 1975,* there is no occupational category called "fine arts." There is a field called "artists, athletes, and entertainers."[5] The University of California uses the category of "fine arts" to include majors in art, dance, dramatic art, music theatre arts, and visual arts. Finally, the Commission on Human Resources and Advanced Education includes actors, artists, authors, dancers, and musicians in the fine arts category.[6]

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SECTION III

METHODOLOGICAL PROBLEMS IN SUPPLY AND DEMAND STUDIES

This section is a brief critique of current studies of manpower supply and demand as viewed by the writers who have a "systems" orientation derived from a combined total of thirty years of experience working with computerized information systems and conducting systems-related research, education, and training.

Our review of the available literature in the manpower supply and demand field (see bibliography) revealed that the relationship between supply and demand is typically treated in an overly simplistic manner in which major factors that may affect both supply and demand are ignored. As a result, the results obtained in these studies are very unreliable. In our view, a major reason for this state of affairs is that those currently conducting manpower supply and demand studies lack a systems orientation. This results in a variety of problems: in a readiness to treat supply independently of demand; to treat job-market demand but not social need; or to ignore critical variables such as the role of the Federal government or the interests, objectives, and values of students who make up the supply element in the labor market.

In this section, we shall review some of the more obvious methodological problems arising from an overly simplistic orientation to manpower supply and demand studies. In the following section we shall present a "systems" perspective to such a study for the state of California.

Using the Past as a Basis for Projecting the Future

One of the most striking weaknesses in typical manpower supply and demand studies is illustrated by the document, *California Manpower Needs to 1975*, published by the California Department of Human Resources Development, and based on the work of the U.S. Department of Labor.[1] In this document the demand for workers in 1975 is based entirely on past employment trends and the past occupational structure.

Our criticism of this approach here is not based on the fact that the Department of Labor's assumptions about economic growth and employment were wrong, since short-range fluctuations in Federal government spending and economic conditions are to be expected, but upon the fact that categories of jobs that existed prior to the development of the demand projections do not make allowances for new types of occupations that are constantly appearing. The U.S. Department of Labor and the California Department of Human Resources Development are not alone in using this approach. Allan M. Cartter, for example, after stating his belief that about one-third too many Ph.D.'s may be produced in the latter part of this decade adds with emphasis: "for the types of employment we have known in the past."[2] Since the history of the occupational structure of the United States is constantly changing and is changing at an accelerating rate, demand projections based on such a qualification are of limited value.

One example of the emergence of two new occupations should suffice to illustrate the difficulty in anticipating demand based on the past. The U.S. Department of Labor in its document, *Occupational Manpower and Training Needs*, Bulletin 1701, published in 1971 states that in 1968 there were 175,000 programmers and 150,000 system analysts. No one that we know of anticipated the tremendous growth in the use of computers that occurred during the decade of the 1960's. Based on the census of 1960, there were no occupational data on the basis of which one could have projected a demand for 175,000 programmers and 150,000 system analysts by 1968. Only a handful of the largest corporations were using computers during the 1955-1960 period. The real growth did not become evident until the early 1960's.

Social Need Distinguished from Job Market Demand

A static concept of the occupational structure (which grows but does not change) is not only inadequate for projecting job market demand, but it ignores completely the types of occupations that may appear as a result of social needs that might give rise to new occupations in industry (performance contracting in education) or large-scale programs supported by government funds (the Peace Corps). Thus, if the supply of college graduates is measured against an estimated job market demand based on economic growth and industrial expansion, we may be producing a surplus of trained manpower; but if that same supply is measured against social needs, we may have a manpower shortage. Under President John F. Kennedy, the creation of the Peace Corps was the response to a perceived social need. If Senator George S. McGovern were to become President, an additional set of jobs might be created in response to his perceived social needs.[3]

The Absence of a Linear Relationship Between College Degrees and Jobs

The overly simplistic approach to manpower supply and demand studies is also shown in the tendency of statistical analysts to use narrowly defined categories when dealing with data related to education and occupations. An effort is made to match graduates with degrees in an academic field against an estimated number of job openings in the same field. This approach ignores the fact that individuals make many career changes in the course of their lives. There is no one-to-one relationship between an individual's education and his career path. On this point, E. Wight Bakke flatly states: "It is not true that most scientists follow a straight career path from their undergraduate major through their adult career."[4] And college students who are not scientists make even greater changes in their career plans.

The simplistic approach to manpower supply and demand relationships assumes that the student graduating with a degree in an identified field will enter an occupation clearly related to the field. Recent calls for "career education" reflect this simplistic viewpoint, particularly when it is applied at the college level. One of the major obstacles to occupational mobility -- the ability to work in an occupation different from the field in which one was educated - is

specialization. A dynamic, constantly changing society such as ours requires a great deal of occupational mobility. Excessive specialization defeats the capacity of individuals to adjust to changing job markets. Thus career education, if it implies early specialization, has inherent dangers which should be recognized. It requires a certainty about the future job market that does not exist for the college graduate.

Supply and demand studies, especially in California, are necessarily simplistic to the extent that geographical mobility of college graduates is not taken into account. Much of the job demand in California in the decades of the 1950's and 1960's was satisfied by a large in-migration of highly educated workers at no cost to the state. Today, the state may be educating college students who will leave the state to find employment. Very little data are available on the subject of geographical mobility, either in terms of in-migration or out-migration. Nor is it known whether the end result has been a net gain or net loss for the state financially.[5]

Changing Job-Entry Standards

It has been shown that educational standards for job entry shift in relation to manpower surpluses and shortages.[6] This is a dynamic feature of manpower adjustment that is commonly ignored in static studies of supply and demand (when supply and demand are defined in terms of fixed quantities and then compared). We know that during the 1960's, for example, educational standards for engineers were lowered in the aerospace and defense industires in California as the demand for engineers rose. In other fields, such as business management, educational requirements were raised in California when there was an available supply of college graduates.

Prior to the 1960's one could become a corporation manager without having a college degree. During the 1960's, a college degree became a mandatory requirement in most corporations. A Master's degree in Business Administration is becoming increasingly a requirement for managers in business. With the growing use by large corporations of operations research, systems analysis, mathematical models, simulation, and computerized management information and planning systems, tommorrow's corporate manager will probably be required to have a Ph.D. Thus, surplus Ph.D.'s may find their way from science and engineering into management. These examples and speculations serve to illustrate the overly simplistic nature of straight comparisons of college degrees with given jobs.

As DeWitt and Tussing point out, it cannot be readily determined how much of educational upgrading is required by the nature of a job and how much is a response of employers to a surplus of available candidates for jobs with degrees.[7] In any case, these shifts in educational job-entry standards cannot be projected when based on past data. There is, then, no fixed quantitative relationship between college degrees and occupational standards, and no way to control the standards that employers may wish to set for most occupations. A surplus of people with college degrees in a given

field may simply serve to create a demand for people with such degrees where no such demand existed before.

The Lack of Data on Student Objectives, Motivations, and Values

A very noticeable gap in the general literature on manpower supply and demand studies and in the data available to us during the present study was the lack of information about student objectives, motivations, and values. In such fields as chemistry, law, social work, and the fine arts, our data show increasing student interest, but we have no definitive information, only speculation, on why this is so. In the fields of law, social work, and the fine arts there is nothing to suggest that students are responding to job market demands. On the contrary, there is evidence of surpluses in these fields right now, with larger surpluses predicted for the future.

It is reported that college students change their career plans a good deal while in college and also make changes between completion of the baccalaureate degree and their entry into graduate or professional school. These changes are reported to be more related to student interests than to the job market.[8] It is also known that about one college student out of three attends more than one college during his college career. However, there are no data on why students change their plans or why the transfer rate is so high.

A key problem appears to be the mismatch between the fields students are most interested in and the lack of a current job market in those fields. There does not appear to be any adequate mechanism or procedure for persuading students to choose careers in those fields where future demand is most likely. This is especially difficult to do, although it may be desirable, since the experts are so frequently wrong in estimating demand.

The Role of the Federal Government

Studies of supply and demand, despite the most thorough research, are unreliable as a result of the powerful influences of Federal funding policies.[9] Job demand may be and has been altered overnight as a result of the turning "on" or "off" of Federal funds. The decline of job demand in the aerospace and defense industries in the late 1960's is a classic example. As a result of the changes in Federal funding policies and other related factors which affect demand, estimates of shortages of engineers and scientists made as recently as 1970 have proven to be wrong. But current surpluses in some fields could also change to shortages overnight if there were new changes in government spending policies. It is difficult, therefore, to place very much reliability for estimating demand based on past trends when the prior period only covers a period of Federal munificence.

Long-Range Versus Short-Range Trends and Projections

A major difficulty with manpower supply and demand studies is

that they too frequently deal with periods of short duration, such as a decade or less, rather than longer periods. Yet, as Burnham Beckwith has pointed out, long-range trends may be more reliable than short-range trends.[10] A major long-term trend which is crucial to analyses of college educated manpower surpluses or shortages is the emergence of what sociologist Daniel Bell has called the "postindustrial society."[11] This type of society, typified by the United States, is a knowledge-based society requiring a highly educated manpower supply. In such a society, educated manpower is in high demand, while the uneducated or undereducated may be unemployable. Thus, as DeWitt and Tussing note, "no one, to our knowledge, has suggested that skilled manpower is likely to confront serious levels of chronic unemployment. The serious problems of unemployment are borne almost exclusively by individuals with low educational attainment."[12] The problem that faces college graduates is not so much unemployment as it is underemployment. For this reason, unemployment rates for college graduates are unreliable measures of supply surpluses and reflect only short-range conditions.

This leads us to the fact that simplistic studies of manpower supply and demand neglect some of the most significant consequences of manpower imbalances. While we have read much about the dangers of having a surplus of highly educated manpower and that it is very wasteful to have such people underemployed, it should be evident that being unemployed, especially if it is chronic, is even more dangerous and more wasteful. This suggests that educational planners should be more concerned about the educationally disadvantaged when there is a surplus of college educated manpower, rather than about those with college degrees. The latter, at least, will be employed at some point in time.

The Effect on Supply of the Women's Liberation Movement

A major long-range trend which is one element of the postindustrial society is the increasing participation of women in the world of work on an equal basis with men. But simplistic studies of manpower supply and demand based on past occupational data cannot project the impact on the supply factor of the women's liberation movement.

It has been recognized in one of the more comprehensive manpower supply and demand studies that the greatest possible sources of further expansion in the professions lies in the future participation of women.[13] Women have not entered many occupations in the past in great numbers because of their traditional roles as housewives and mothers. But the most recent national birth statistics for the first quarter of 1972 show that birth rates have dropped sharply toward what is called the "replacement level" or 2.11 - the number of children women must bear, on the average, to replace the population.[14] The current rate is estimated by the National Fertility Study as under 2.14, the lowest in history for the United States. The study's authors write that "American couples have changed their reproductive behavior radically... stabilization of population size is within reach."[15] The decline in births is not regarded as a fad. A number of social forces are allegedly responsible. These include, among

other things, a "swelling interest in women's liberation and more working wives."[16] Thus the potential supply of women workers in the future may be much higher in the 1970-80 decade than any simplistic supply and demand study would indicate.

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SECTION IV

A SYSTEMS APPROACH TO EDUCATIONAL PLANNING

Education and Manpower Supply and Demand Studies

Our review of the methodological problems in manpower supply and demand studies in the previous section makes clear that such studies deal at many points with the interrelationships among educational institutions, the job-market, and Federal, state and local government. These relationships are currently a very loosely articulated structure.

The term "system" is widely used in the educational literature with reference to this structure of relationships but with many different meanings. California is sometimes said to have a statewide system of higher education composed of four segments: the University of California, the California State University and Colleges, the independent colleges and universities, and the community colleges. State educational planning agencies, such as the Coordinating Council for Higher Education, are continually concerned with various problems and issues involving relationships among the segments of higher education as a "system". The Council is also interested in the nature of interdependencies between institutions of higher education and supply and demand factors affecting college educated manpower in the labor market. Studies of manpower supply and demand, as we have noted, also assume some form of systemic relationship between educational institutions and the job-market in which the "output" of the former are the "input" to the latter. The Federal government in its funding policies which support both individual students and educational institutions, assumes systemic relationships between such support and the nation's welfare and security. The U. S. Department of Labor and the California Department of Human Resources Development also consider the supply of college graduates in their estimates of manpower surpluses or shortages. The State of California clearly recognizes that the economic welfare of the state is dependent in large measure upon a continuing supply of highly educated manpower. However, it is also concerned that the financial support provided to educational institutions by the State provides appropriate benefits to the State commensurate with the ever-increasing revenues generated by the taxpayers. But do these structured relationships constitute a system?

Non-System Characteristics of Higher Education in California

Rational statewide educational planning requires a management information system that would provide information to facilitate planning, for the same reasons that managers of today's large corporations need management information systems to plan their operations in a rational manner. The State of California clearly has no such system at the present time. This is hardly surprising since education in the State is not really a system in the technical sense, nor was the relationship between higher education and the job-market ever designed as a system. Yet imbalances between manpower supply and demand, whether they happen to be surpluses or shortages, give rise to criticisms of educational "system" planning in the State and reforms

or changes in educational curricula or programs are urged when such shortages or surpluses occur.

That a system of higher education does not, in fact, exist in California is not just the viewpoint of the writers. This conclusion was reached in an earlier report on public and private higher education in California, *The Challenge of Achievement*, prepared for the Joint Committee on Higher Education of the California Legislature. The authors of this report write:[1]

> California's higher education structure is at once highly stratified and highly fragmented. No single agency has authority and responsibility for statewide policy development, the establishment of new institutions, the approval of new programs, or comprehensive financial planning. In past years each of the three public segments has been able to add enrollment, develop new programs and activities, build new facilities and budget available funds with little attention to similar activity and expansion in the other two segments.
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> . . .
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> Except for isolated informal arrangements between individual institutions with a strong common interest, the three segments are operated as if they were in three different states. The consequence is duplication of effort, needless competition and, most seriously, lost opportunities for productive cooperation in teaching, research and community service activities.
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> . . .
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> No agency below the level of the Governor and the Legislature has authority to reallocate resources among the segments according to changes in statewide needs and objectives.
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> . . .
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> The justification for continuing the existing stratification of public higher education appears to be based entirely upon historical accident and historically nourished loyalties, not upon a careful assessment of the State's needs, the needs of the local communities or the needs of the institutions themselves. As each segment has grown, adding programs and enrollment, its independence has been carefully protected, and much effort has gone into attempts to identify different objectives and to spell out functional differences, so as to justify the continuance of the three separate systems.

We need only add to this description of a non-system, which is limited to the three public segments of higher education, that as one broadens one's viewpoint to encompass the non-public educational institutions and the relationship between educational institutions and the job-market, any illusion that there is a "system" is quickly

dissipated. From an historical perspective, the educational structure in California and educational planning in the State appear to be at the stage of development that military command and control systems were in during the decade of the 1950's and the stage reached by industrial corporations in the 1960's. But in addition to this historical lag, there is an additional complication in that the complexities of the educational structure, as well as the dynamic relationships between educational institutions and the job-market, are less amenable to system analysis and to conceptualization as a system. It is essential, however, before proceeding further with this discussion, to clarify what is meant by the term "system".

Definition of a System and System Concepts

A system has been defined as "a readily identifiable assemblage of elements or components (objects, persons, activites, etc.) that are united by some form of regular interaction or interdependence so as to function as an organized whole."[2] In addition, "when the system is in operation, it is designed to accomplish designated results or to achieve a specified mission or a set of objectives."[3] On the basis of this definition, the current structure of higher education in California does not constitute a system since it is not an organized whole united by regular interaction, nor does it have a specified mission or a set of objectives.

While the definition of a system presented above is adequate as a starting point, it is desirable to list below in a more comprehensive form the major attributes of a system that must be taken into account in any system analysis. A system possesses:

1. elements or components which are interdependent - sometimes referred to as subsystems

2. operations, functions, or processes which are performed by subsystems either in an integrated or semi-integrated fashion (the degree of integration will vary with the type of system)

3. inputs - the persons, data, or events upon which operations, functions, or processing are performed

4. outputs - the results or products of the operations, functions, or processing

5. objectives of the system as a whole - clearly defined objectives for the system provide the criteria for evaluating the system's performance

6. an environment in which the system operates - the environment provides the inputs to the system and constrains its operations in a variety of ways

7. a boundary - the system must be demarcated from its environment in some rational and pragmatic fashion

It is important to note that the entities that comprise a system are relative to the viewpoint of the observer outside the system. Thus, an entity that is a "system" to one observer is a "subsystem" to another. One of the basic problems in systems work is determining the boundary of the subject system. In industry, for example, departments or divisions within a corporation were frequently conceived as independent systems and, after much trial-and-error, wasted resources, and loss of time, the system concept was enlarged to encompass the entire corporation.[4] Education in California suffers from this sort of problem. Where is the system boundary? Can we identify a system at all? To a college president, the college may be regarded as a system, unique and independent. To the Chancellor of the California State University and Colleges, a college may be regarded as a subsystem within the larger statewide system which he directs and for which he is responsible. And to the members of the Coordinating Council for Higher Education, the public colleges may be only subsystems of a still larger system of higher education. Is the job-market part of the system or does it use the outputs of the system? There are no simple answers to these questions.

To facilitate the following discussion of the system concept as applied to the structure of higher education in California, we present our view of this structure. It must be stressed that the concept is presented here for illustrative purposes only. It serves primarily to provide a common frame of reference and a basis for communication in a difficult and technical area. We do not mean to imply in what follows that the system we describe should be or is the system of higher education in California. This would be presumptuous on our part and is beyond the scope of this study. But without this or some alternative concept, any discussion of a system of higher education in California is purely academic.

A System Concept of Higher Education in California

Figure 1 presents one possible concept of the system of higher education in California. The figure shows in a highly simplified schematic the higher education system composed of seven major subsystems enclosed within the heavily lined box. No attempt is made to show subsystem interrelationships in the diagram. The system's environment includes, Federal, state, and local governments and the job-market demand generated in the economy. Three types of job-market demand are shown in the figure - government, academia, and industry. The inputs to the system of higher education are the graduates of the secondary schools, also shown as part of the environment of the system. The supply of people for jobs in industry coming directly from the secondary schools as dropouts or as graduates are shown at the bottom of the figure. Some proportion of this supply feeds into a category of "unemployed" or "unemployable". A supply of college and university graduates, as well as graduates of proprietary schools, apprenticeship training programs, and other training programs in industry, are shown in the figure as outputs of the system feeding into the job market. Some proportion of this supply ends up enemployed. No formal "feedback" mechanism is shown in the figure. However, data pertaining to such

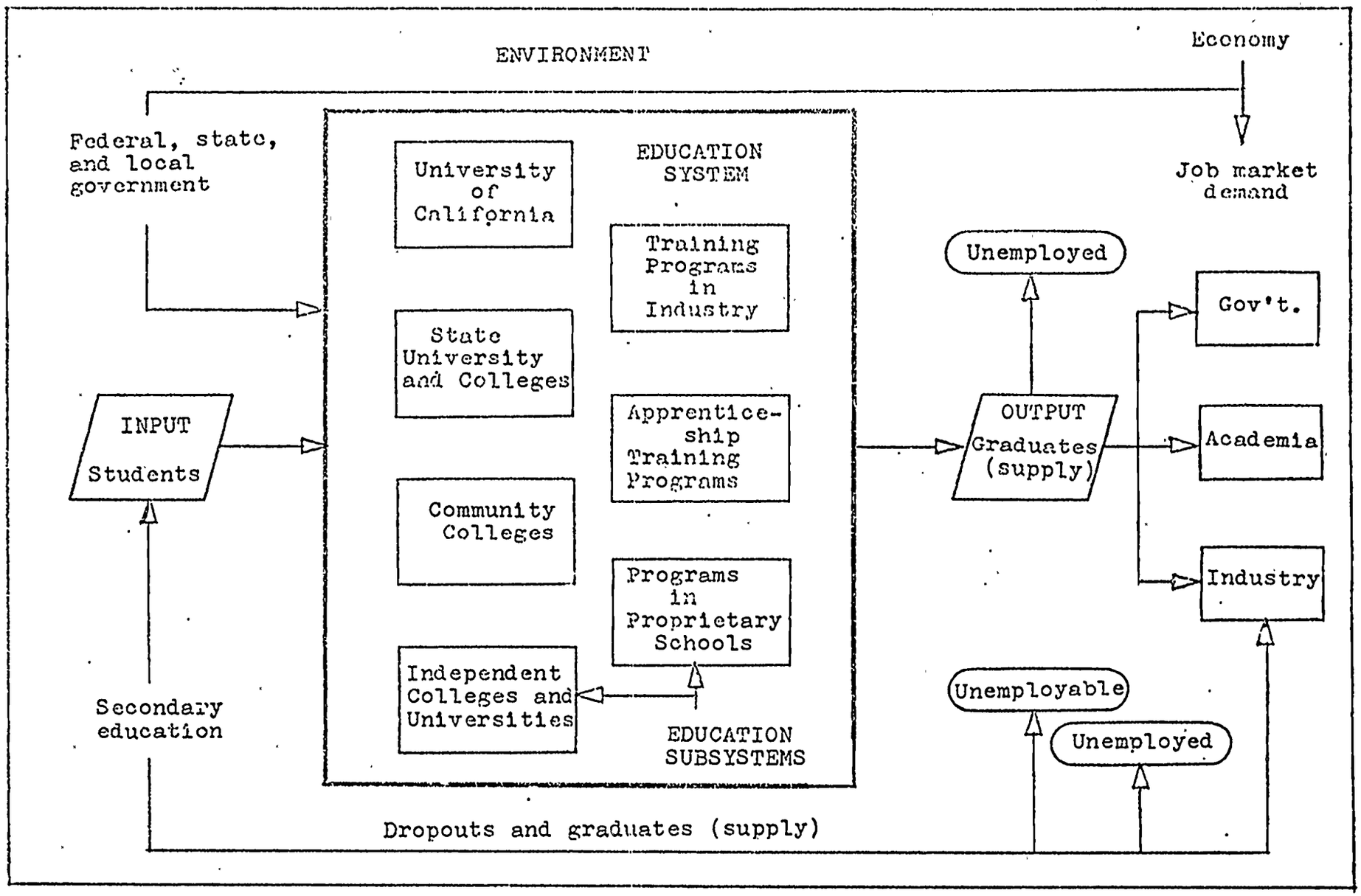

FIGURE 1. A SYSTEM CONCEPT OF THE STRUCTURE OF HIGHER EDUCATION AND ITS ENVIRONMENT IN CALIFORNIA

categories as "unemployed" and "unemployable" may constitute feedback to the system, as would information about surpluses or shortages of supply of graduates in the job market. Presumably such feedback would be of interest to the Coordinating Council for Higher Education, the statewide educational planning agency. With this system concept as a background, we shall review several important aspects of system design and discuss their relevance to educational planning. These aspects include: (1) system objectives, (2) system requirements, (3) subsystem interfaces, (4) standardized data elements, and (5) feedback.

System Objectives

Man-made systems are designed to meet an objective or set of objectives. In education and in the related area of manpower supply and demand there is no common set of objectives. The literature in these areas shows that there are many different kinds of objectives depending on where one happens to be in the overall structure. An instructor in a college may believe his objective in teaching is to reproduce his own kind; a university president may believe his objective is to expand the range of graduate programs offered by his institution or increase research grant activities; a Chancellor or the President of one of the segments may believe his primary objective is to build up the Ph. D. degree programs offered by the individual institutions in his segment; a state official may believe the primary responsibility of higher educational institutions is to prepare graduates by means of "career education programs" to enter the job-market; and so on. These multiple objectives, which may be conflicting, inconsistent, or irrelevant, create a sense of confusion in the educational enterprise and make the development of a rational educational planning function extremely difficult.

As noted earlier in the quotation from *The Challenge of Achievement*, the growth of the educational structure in California has not reflected any consensus on objectives but is largely the outgrowth of historical accident.

System Requirements

System requirements are the performance characteristics or "specifications" of a system based on the system's objectives. In designing a system, one would not attempt to specify the volume of inputs the system must be able to process and how quickly without first determining what the system is designed to accomplish. An airline's seat reservation system, for example, must be able to process a large number of requests every day but it also must be able to respond to requests within seconds. One could not rationally design such a system without knowing that the element of time is critical for optimal system performance. Timely response, in this case, is one of the system's important performance requirements. A major task in system design is the detailed analysis of a system's performance requirements based upon the definition of the system's objectives. Much of the difficulty in the design of systems for computerized operations is that

system requirements have been specified, too frequently, without a clear set of objectives. The result may be a system that works, but it is a system that operates too slowly, or it cannot handle the volume of inputs required of it, or it presents the results of operations in a form that the users of the system cannot apply.

Many large organizations today in industry, government, and education operate inefficiently because they have evolved over many years without ever going through the rational process of deriving performance requirements from defined objectives. As we saw in the quotation from *The Challenge of Achievement*, this is the present situation in our statewide higher education system in California.

Subsystem Interfaces

A large system is usually composed of interdependent subsystems which are derived from the system requirements. These subsystems are differentiated by the distinctive functions they perform. Departments or divisions of a large corporation, such as finance, sales, marketing, production, inventory control, personnel, etc., are examples of commonly recognized subsystems in industry.

In the systems literature, subsystems are said to "interface" with one another when they exchange information. Typically, the output of one subsystem is the input to another. To illustrate from industry again, information about sales may be inputs to the production department; while the output of production may be an input to the inventory control subsystem. The exchanges of information among the various subsystems that comprise a system may be extraordinarily complex depending upon the nature of the enterprise. Some subsystems may be closely integrated, as in the relationship between production and inventory control in a manufacturing concern, while the personnel department may be relatively independent of these two subsystems.

A major portion of systems analysis and design is devoted to the identification of functions that must be performed by the system as a whole, the allocation of functions to subsystems, and the creation of appropriate subsystem interrelationships. Systems are frequently designed inefficiently because the subsystem functions and interrelationships reflect historical and independent development rather than a rationally integrated design based on a commonly accepted set of objectives. Efficient subsystem interfaces cannot be designed without agreement among the interdependent subsystems about such items as the data or information to be exchanged, the frequency and timing of such exchanges, the format and content of the data to be exchanged, and the volume of such data. In the design of such subsystem interfaces, the system designers must also specify how the exchanges of data are to be monitored and what will be the ultimate disposition of all data items. For example, some data records will be stored for varying periods of time for historical and planning purposes, while other data are discarded. In any event, the disposition of such data should be the result of a rational design decision.

The Challenge of Achievement, in its review of the problem of student flow and attrition, brings out some of the gaps and inadequacies in the subsystem interfaces of the California structure of higher education.[5] It notes that one of the strengths of the structure is the wide availability of two-year vocational and technical curricula. But it also points out that, from a system's perspective, if one wants to analyze the relationship between enrollment in the community colleges and graduates of the four-year colleges, the data to do this are not available since it is not known how many community college students who want to transfer to the four-year schools become dropouts instead.[6] Similarly, the Report notes that many students who leave the University of California eventually get degrees at other institutions but data on such transfers can only be estimated. Adequate records on the flow of students among the segments of higher education are not kept.

Records are kept of inputs (enrollment), since the California Department of Finance uses such data provided by the segments (subsystems) to measure academic load for current budgeting purposes. But, as the Report notes, output (degree) records are not related to the budgetary process so that "it is quite possible under this system that appropriations might continue to rise while the number of students who complete programs and receive degrees declines."[7] Another consequence of the failure of the system to follow individual students either as dropouts or as they transfer from subsystem to subsystem is that the academic career patterns of groups of students cannot be traced. The current system of student data recording cannot distinguish between inter-institutional transfers and permanent dropouts.[8] In industry, no corporation would be able to operate for long if it used an inventory control system in which items in the inventory were allowed to disappear with no record of their disposition, such as identifying those items which have been sent to production for assembly, those that have been retained in inventory, and those that have been discarded as waste.

It is difficult to see, from a systems point of view, how rational statewide educational planning is possible when the basic "product", the student, is not "tracked" through the "system" so that his location and status are known at all times. This is true not only while the student is enrolled in one of the subsystems, but also after he leaves the subsystem as a graduate. While it is not the responsibility of the writers to define the objectives of higher education in California, it would seem to us only rational that what becomes of a system output (a graduate with a particular kind of degree) is a question the system should be able to answer for a statewide educational planner. The system should be able to report, upon request, if its products have become employed, unemployed, underemployed, or unemployable. Without such information (feedback), it is difficult to see how the system's performance can be evaluated and perhaps modified if such action appears warranted. An alternative view is that the system's objective is merely to produce graduates of various types. If this is the case, no one can fault

the system for creating a surplus or a shortage of graduates. Clearly, what is at issue here is a policy decision on the common objectives of statewide higher education in California.

Standardized Data Elements

Norbert Wiener and other experts on cybernetics have noted that information is an essential feature of organization.[9] In the performance of any organized entity or system, data must be collected and monitored if measurements are to be made concerning the performance of the system. And data, to be meaningful, must be standardized. Communication is not possible, for example, without agreement on the form and meaning of a set of letter, as in the alphabet. Man-made systems of all kinds require the establishment of standardized data elements depending upon the objectives of the system. The California Department of Motor Vehicles uses, for example, the standard of six alpha-numeric characters for its license plates - any combination of three letters and three numbers. Without such standardization there cannot be a system for automobile licensing.

There cannot be a system of higher education in California, no systematic study of manpower supply and demand, and no rational educational planning without standardized data elements pertaining to such key factors as students, degrees, enrollment, occupations, and so on. One cannot plan educational programs if data on enrollment is collected by one institution based on full-time-equivalents and by another based on average daily attendance. The establishment of the Higher Education General Information Survey (HEGIS) has been a major step forward as a basis for institutional recordkeeping that can be used on a statewide basis. One of the objectives of the HEGIS is "to construct a list (of discipline specialties) which is acceptable and practical for general institutional recordkeeping, for management information systems, and for program budget structure employed by higher education institutions."[10] As the document describing the HEGIS specialty codes points out, "no centrally prepared list can precisely match the pattern of discipline titles and content within all institutions."[11] This is indeed, the dilemma in establishing standardized data elements for management information systems used for planning purposes in education. Unless all higher educational institutions in California agree to follow the HEGIS codes, or unless some central authority can make the codes mandatory, an efficient management information system and rational planning is difficult to achieve. One cannot plan or monitor an operation without agreement on the substantive nature of the operation.

Attention should be called to the danger of having the various segments that comprise the higher education structure in California independently develop their own computerized student information systems using non-standardized data elements. A fragmented approach of this nature will lead to a situation that too frequently occurred in industry when computers were first introduced. It was not uncommon for each division or department of a corporation to design its own

information system. The result was that the eventual re-design of an integrated, corporate-wide information system was extremely costly and wasteful of limited resources. This danger for education in California is recognized in *The Challenge of Achievement* which states:[12]

> To the extent that some schools and colleges are still developing computer-based student information systems, every effort should be made to coordinate the design of these developing systems with the needs of the statewide system in mind. By so doing, the necessity for subsequent changes or modifications of these systems can be minimized. The resulting economies can be substantial.

Statewide educational planners should be cognizant of the ultimate cost to the taxpayers if independently developed computerized management information systems must be integrated in the future to meet the needs of the statewide planning functions of the Coordinating Council for Higher Education. It cannot be assumed that the sum of information systems that satisfy the needs of subsystems will also satisfy the needs of the system as a whole.

Feedback

"Feedback" is the property of being able to adjust future conduct based on past performance. The concept has been applied to machines, organisms, and complex systems of many types. As Norbert Wiener notes, "feedback may be as simple as that of the common reflex, or it may be a higher order feedback, in which past experience is used not only to regulate specific movements, but also whole policies of behavior."[13] In a man-made system, feedback is a method of controlling the system's operations by "reinserting into it the results of its past performance."[14] We are familiar with the principle of feedback in everyday machines such as the elevator and the furnace. We may be less familiar with applications of this concept in the automation of processing plants, as in the steel, chemical, cement, and petroleum industries. Administrative processes in industry are also using the feedback concept to monitor and control various types of operations, such as inventory control. In such systems, a computer is used to reorder an item automatically as soon as it receives information that the amount of the item in stock has fallen below a pre-established reorder point.[15]

The concept of feedback in higher education is important because it is conspicuous by its absence. That is, educational institutions do not now receive sufficient information about their students. Colleges and universities do not know how many of their graduates with a particular degree actually enter a profession requiring that degree for entry. Students may drop out of school or transfer from one college to another without the administrative officials "tracking" them. Students, as well as the information about them, become lost to the system. It is not known if students receiving similar degrees

in the same college, in different colleges, or in different segments of higher education perform equally well once they are employed. State officials do not know how the funds spent on education contribute to the economic growth of the state. Without feedback about these matters, educational institutions cannot rationally modify their future conduct based on past performance.

One of the functions of a feedback mechanism is to prevent a machine, an organism, or a system from overreacting to stimuli in its environment. Overcompensating for stimuli may result in oscillations which can cause a machine, organism, or system to run out of control. Thus, the purpose of feedback in an inventory control system is to prevent the oscillations of building up excessive inventories, at considerable expense, or the depletion of inventories to the point where production cannot keep pace with sales, again resulting in unnecessary expense.[16] One of the conspicuous features of the relationships among educational institutions, the Federal government's funding policies, and the job-market is the oscillations that occur whereby, over relatively brief periods of time, surpluses or shortages of college graduates occur in specific occupations. Surpluses of certain types of graduates are to be expected if the institutions producing those graduates have as their objective the production of as many graduates as possible within the limitations of funding provided. Surpluses may also occur if an implicit objective is growth for the sake of growth. A surplus may also be the result of cutbacks in Federal spending which reduces job-market demand for certain types of graduates. The design of an appropriate feedback procedure to prevent such oscillations requires some consensus on the system's objectives.

Summary

The general relationships among system objectives, system requirements, subsystem interfaces, standardized data elements, and feedback and some associated propositions may be briefly summarized:

1. The first step in the design and development of a system is the creation of an objective or a set of objectives that are acceptable to the users of the system.

2. The performance requirements of the system are derived logically from the pre-established system objectives.

3. A system should not be faulted or criticized for failing to meet performance requirements that were never derived from its defined objectives.

4. Waste and inefficiency are the results when subsystems of a larger system are allowed to develop their own computerized management information systems independently; such subsystem information systems do not automatically satisfy system-level objectives or requirements.

5. The exchange of information among subsystems should be based on the rational allocation of functions among subsystems as required to meet overall system objectives.

6. Subsystems can interact efficiently only if they have the capability to exchange standardized data elements.

7. The performance of the system can be monitored and controlled on a rational basis only if standardized data elements are used throughout the system.

8. Data collected for monitoring and control purposes should be evaluated against pre-established objectives of the system.

9. Action must be taken in a timely manner to correct deviations from system objectives and to control future operations so that stable, optimal performance is achieved and excessive oscillations are avoided.

It appears evident to the writers that the contemporary structure of higher education in California and its relationship to its environment does not constitute a "system" in any meaningful, technical sense. The linkage between educational institutions and the job-market is especially ambiguous. Furthermore, no system in the terms described in this section can be created unless there exists some central agency with the authority to establish the objectives of that system. No such state agency below the level of the Governor and the State Legislature now exists.

Students are "processed" by educational institutions, but few traces of them are maintained in the form of useful records for statewide purposes. Some records are kept, such as enrollment data, to satisfy the needs of certain state agencies, but the detailed and standardized data needed for statewide educational planning do not exist. The design of a rational management information system that would assist such planning would be a major undertaking. Unfortunately, in the absence of a statewide approach, individual colleges and segments are creating their own, unintegrated management information systems. Integrating these independent systems at some future time will place a severe burden on the resources of the state. However, the longer the effort to achieve statewide integration is delayed, the greater will be the ultimate cost. In the meantime, the emergence of a large number of independent management systems will make statewide planning increasingly difficult.

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SECTION V

SUPPLY AND DEMAND IN SELECTED OCCUPATIONS AND OTHER MANPOWER DEVELOPMENT PROGRAMS

A. ENGINEERING

Introduction

The relationship between supply and demand in engineering is of great importance in this study since a large proportion of engineers in California are employed in the aerospace and defense industries. Employment in these industries comprises one-third of total California industrial employment. The State is, therefore, unusually sensitive to shifts in Federal funding for aerospace and defense purposes. The significance of employment trends for the California aerospace industry is shown in Table 1.[1]

Engineering, the second largest profession (next to teaching), provides the largest single source of employment for men in the professions. Nationally, there were over one million engineers employed in 1968. Nationally, as well as in California, aerospace and defense contractors are major employers of engineers. Sultan notes that in 1969 about 40 percent of the 90,000 physical scientists and engineers who graduated were employed in aerospace and defense industries.[2]

The field of engineering includes more than college graduates. Only about 56 percent of the persons defined as engineers in the 1960 census had four-year college degrees.[3] Sultan estimates that in 1966, about 70 percent of all engineers had an engineering degree.[4] Practical experience has been a well-established route into engineering, especially during the 1950-1965 period when the field grew rapidly.

The community colleges in California produce graduates of two-year "Associate Degree Programs" identified by student major fields, such as "engineering." The graduates of these programs must also be considered part of the total supply of engineers in the state. In this study we shall not be concerned with persons entering the field of engineering without college degrees of any kind, but we shall include the graduates of the community colleges with majors in engineering in our total supply of engineers, in addition to the graduates of the California State University and Colleges, the University of California, and the independent colleges and universities. We shall also aggregate all degree levels since job demand data we have examined in this study do not always differentiate between the baccalaureate, Master's and Ph.D. degree levels.

California Supply of Engineers

The estimated supply of engineers with two-year associate, baccalaureate, Master's and Ph.D. degrees produced by all California colleges and universities, both public and private, for the academic years 1967-68 through 1970-71 is shown in Table 2. Data were not

TABLE 1

AVERAGE ANNUAL EMPLOYMENT TREND FOR THE CALIFORNIA AEROSPACE INDUSTRY

1966-1971

Year	Employment	Change From Prior Period	
		Numerical	Percent
1966	549,000	67,000	13.9
1967	597,000	48,000	8.7
1968	598,000	1,000	0.2
1969	569,000	-29,000	-4.9
1970 (estimate)	495,000	-74,000	-13.0
1971 (forecast)	455,000	-40,000	-8.1
Five year change: 1966 to 1971		-94,000	-17.1

Source: Paul Sultan, The Demand for Professional Personnel in California, mimeographed, undated, p. 19.

available from the community colleges for academic years 1969-70 and 1970-71, and from the independent colleges and universities for academic years 1967-68 and 1968-69. The degree production for these years was estimated from the data provided by the State University and Colleges and the University of California.

For estimating purposes, we have assumed that the increase in the number of degrees produced by the community colleges and the independent colleges and universities from 1967-68 through 1970-71 would be approximately similar to the increase in number of degrees produced by the State University and Colleges and the University of California during the same period of time. To obtain the estimated degrees produced by the community colleges in academic year 1969-70, we took the average of the actual increases in degrees produced by the State University and Colleges and the University of California from academic years 1968-69 to 1969-70 (125) and added that average increase to 1,743, the number of degrees produced by the community colleges in 1968-69. To obtain the estimated degrees produced by the independent colleges and universities for academic year 1968-69, we used the same actual average increase of 125 and subtracted it from 2,132 (the number they produced in 1969-70). Similar procedures were used to obtain the estimated degrees produced by the community colleges for academic year 1970-71 (163). Adding 163 to 1,868 results in a figure of 2,031. To obtain the estimated degrees produced by the

TABLE 2

SUPPLY OF ENGINEERS, ALL DEGREES, PUBLIC COLLEGES AND UNIVERSITIES, INDEPENDENT COLLEGES AND UNIVERSITIES, COMMUNITY COLLEGES, ACTUAL AND ESTIMATED

1967-68 THROUGH 1970-71

Academic Year	Community Colleges	Net Change	% Change	Independent Colleges and Universities	Net Change	% Change	State Univ. and Colleges	Net Change	% Change	Univ. of Calif.	Net Change	% Change	Total Degrees	Net Change	% Change
1967-68	1,597			1,776*			1,669			1,782			6,824*		
1968-69	1,743	146	9.1	2,007*	231*	13.0*	2,004	335	20.1	1,993	211	11.8	7,747*	923*	13.5*
1969-70	1,868*	125*	7.2*	2,132	125*	6.2*	2,226	222	11.1	2,021	28	1.4	8,247*	500*	6.5*
1970-71	2,031*	163*	8.7*	2,342	210	9.8	2,361	135	6.1	2,212	191	9.5	8,946*	699*	8.5*
												Grand Total	31,764*		
Three year change:		434*	27.2*		566*	31.9*		692	41.5		430	24.1		2,122*	31.1*

Source: Actual degree data provided by the Office of Analytical Studies, University of California; Office of Institutional Research, California State University and Colleges; Association of Independent California Colleges and Universities; and the Office of the Vice Chancellor, California Community Colleges.

*Note: Estimated figures based on averages of actual data provided by the above sources.

independent colleges and universities for 1967-68, we took the average of the actual increases in degrees produced by the community colleges, the State University and Colleges, and the University of California from 1967-68 to 1968-69 (231). Subtracting 231 from 2,007 results in 1,776, the figure shown in Table 2.

Although the degree production of the community colleges and the independent colleges and universities for the years indicated in Table 2 are only estimates, we feel they are reasonably close to the actual figures since the upward trend for the data that are available seems consistent for each of the segments.

The grand total of all degrees produced in engineering for the four segments of higher education in California for the academic years 1967-68 through 1970-71, including both actual and estimated data, is 31,764, as shown in Table 2.

We turn now to the problem of estimating degree production in engineering for academic years 1971-72 through 1974-75. Normally, one would extrapolate the increases at the overall rate shown for the years 1967-68 through 1970-71 in Table 2 (31.1 percent). However, there is evidence of a sharp decline in national enrollments in engineering programs which must be taken into account. This decline is such that a straight extrapolation of past degree production could not be used with any reliability to project the future supply of engineering degrees.

Available information at the national level indicates that enrollments in engineering are falling. Betty Vetter, the Executive Director of the Scientific Manpower Commission, reports in *Science*, April 7, 1972 that nationally, in the fall of 1971, graduate school enrollment in engineering dropped 7.8 percent, while undergraduate enrollment declined a huge 17.1 percent. A year earlier the decline in undergraduate enrollment was only 1.7 percent.

In California, available data on general campus enrollment indicate a decline in 1971-72, but we lack current definitive data on enrollment in engineering.

Drops in general enrollment are reported for many educational institutions in California according to the *Los Angeles Times* of April 30, 1972. The University of California at Los Angeles' general campus (not including the health sciences complex) has had a 10 percent decline this year from the 1970-71 academic year. The eight general campuses of the University of California (not including the medical center in San Francisco) dropped about 4,000 below expected enrollment in the fall of 1971, with total enrollment remaining almost static. Full-time student enrollment in the State University and Colleges dropped 8 percent below estimates this year and the community colleges had a 4 percent decline in enrollment. Enrollment data for the fall of 1971 at the independent colleges and universities are not available in the *Los Angeles Times* report, but the Independent Association of California Colleges and Universities did report a decline of about

8 percent in applications for next fall among its 52 members. The California Institute of Technology reports a drop of 20 percent in freshman applications this year.

Turning now specifically to engineering enrollment, available data show a decline in freshman enrollment at the University of California beginning in 1968 (see Table 3). The report from which the data in Table 3 were taken cites the figures as evidence of the declining attractiveness of engineering to students since the decline occurred during a period when enrollments as a whole for the University were increasing. Table 3 shows that freshman enrollment in engineering declined by 110 students or 9 percent from 1967 to 1968. This decline in enrollment should be reflected in a similar decline in baccalaureate degrees four years later in 1971. However, our data in Table 2 show that degree production at the University of California increased by 9.5 percent in academic year 1970-71. This discrepancy suggests that enrollment at the freshman level can only be used with caution for degree projection since transfer students from the community colleges and the state colleges are not reflected in such enrollment figures. Unfortunately, we have no data on such transfers during the key period from 1968 to 1971.

TABLE 3

UNIVERSITY OF CALIFORNIA FRESHMAN STUDENTS
ENROLLED IN ENGINEERING
FALL QUARTER

Year	Students Enrolled	Net Change	% Change
1965	882		
1966	1,111	229	26.0
1967	1,222	111	10.0
1968	1,112	-110	-9.0
1969	1,025	-87	-7.8
1970	1,057	32	3.1
1971	1,025	-32	-3.0

Source: Adapted from: Present and Future Technological Employment in California, A Report to the Assembly General Research Committee, California Legislature, Appendix B, December, 1971, p. 25.

At the State University and Colleges, as shown in Table 4, there is no evidence of a decline in total enrollment in engineering, either at the undergraduate or graduate levels, although the rate of increase has declined sharply. Since the students reflected in Table 4 are committed to at least a four-year program, there would be no absolute decline in degree production until the freshman cl...s of 1971 graduates in 1974, assuming there is an absolute decline in enrollment in engineering in 1971. Unfortunately, enrollment data by specialized field for 1971 from the State University and Colleges are unavailable.

TABLE 4

ENROLLMENT IN BACCALAUREATE AND GRADUATE ENGINEERING PROGRAMS, CALIFORNIA STATE UNIVERSITY AND COLLEGES

1967-1970

Year	Undergraduate	Net Change	% Change	Graduate	Net Change	% Change
1967	9,377			1,304		
1968	10,548	1,171	12.5	1,561	257	19.7
1969	10,708	160	1.5	1,744	183	11.7
1970	11,226	518	4.8	1,758	14	0.8

Source: Statistical Abstract, 1971, The California State University and Colleges.

Some percentage of the community college graduates of two-year engineering programs who might normally enroll in the 1971-72 academic year would be graduating in the following academic year. If we assume that enrollment in engineering at the community colleges is approximating the general campus decline of 4 percent in enrollment this year, or may be an even larger decline in light of the national data, a decline in majors in engineering programs would occur in 1972-73.

Several reasons may be offered to explain the decline in enrollment this academic year:

1. Rising costs of higher education, especially at private institutions.
2. A decline in federal funds for fellowships, traineeships, and research assistants from the peak year, 1967-68.
3. A poor job market for college graduates.
4. Disenchantment with higher education on the part of both parents and students.
5. The feeling of many students that higher education programs are irrelevant to more pressing social problems.
6. The advent of the draft lottery and the elimination of exemptions for college students (freeing young men to work or travel).

7. A trend toward "deferred admissions" in which students are accepted by a college but are not required to attend for a year or two.
8. A general disenchantment with science and engineering accompanied by a switch in interest to "people-related" programs.

Close observers of the educational scene believe, however, that the negative attitude of students toward a field such as engineering is only a temporary phenomenon. The director of admissions at the California Institute of Technology is quoted as saying in the *Los Angeles Times* article referred to above, that young people have turned against science and engineering because "they feel technology has made a botch of things in general." But he believes that "by next year common sense will return... people will realize that if we're going to get rid of pollution, it's going to be the scientists and engineers who are going to do it."

In light of the data on declining rates of degree production shown in Table 2, declining enrollments in Tables 3 and 4, and the evidence of declining interest in engineering both nationally and in California as indicated earlier, we have made two alternative projections of the number of degrees that may be produced in engineering from academic year 1971-72 through 1974-75. The first projection is based on the assumption that past growth rates are no longer meaningful and that approximately the same number of degrees produced during the past four years (31,764) will be produced in the next four years. This would result in a total number of 63,528 degrees from academic year 1967-68 through 1974-75.

The second projection assumes a decline of 5 percent in degree production, or 1,588 degrees, from 1971-72 through 1974-75. This would amount to an estimated 30,176 degrees produced for this period and a total of 61,940 degrees from 1967-68 through 1974-75. A decline larger than 5 percent is a possibility that cannot be ignored. However, we have no data specific to California on which to base a larger decline. The most significant factor is that most of the students who will be graduating during the period from 1971-72 through 1974-75 are already enrolled in engineering programs. It should be stressed that after 1975 a sharp decline in engineering degrees in California may occur. We should also note here that attrition rates have not been considered in our supply projections since such data were not available. Nationally, attrition rates in schools of engineering have ranged has high as 50 to 60 percent. If attrition was included in our supply projections, the decline would be larger than we have indicated.

California Demand for Engineers

The official source of data on the demand for engineers in California is *California Manpower Needs to 1975* published in October, 1969 by the California Department of Human Resources Development. According to this document, the total demand for all types of engineers

from 1968 through 1975 will be 66,400. This figure includes 50,600 new jobs created by industrial expansion and 15,800 for replacement needs resulting from deaths and retirements.

If we compare our two alternative supply projections of 63,528 and 61,940 degrees for the same period of time with the official demand figure of 66,400, the results are an estimated shortage of 2,872 for the first alternative and a shortage of 4,460 for the second alternative.

Unfortunately, the estimated demand made by the Department of Human Resources is based on national assumptions as set forth in *Tomorrow's Manpower Needs*, Bulletin Number 1606, published by the U.S. Department of Labor in February, 1969. These assumptions include a national civilian labor force of 91.4 million in 1975 with a national unemployment rate of 3 percent. It is also assumed there will be no war or other cataclysmic event that might affect the rate and nature of economic growth, and that research and development (R & D) expenditures will continue to grow but at a slower rate than in the decades of the 1950's and 1960's. The average 1975 civilian labor force in California is estimated at 9,600,000 with an unemployment rate of approximately 4.5 percent.

The assumptions made by the U.S. Department of Labor were made prior to the economic downturn of 1969-1971 which was not foreseen and the spectacular decline in Federal funding for R & D, airlines, defense and aerospace activities (see Table 5). The total peak funding was in 1968 at 11.4 billion dollars and declined steadily thereafter. The estimated demand of 66,400 new engineers between 1968 and 1975 for California is, therefore, unreliable and probably far in excess of job demand conditions that will exist during that time period. Therefore, these figures may only be used as a base of departure for comparing supply with demand and for reviewing some of the key problems in evaluating supply-demand relationships.

Problems in Estimating Engineering Supply and Demand

Unemployment in Engineering

While the source documents we have examined on unemployment among engineers disagree on the exact number of unemployed in California; all agree that the rate is higher in this state than in the nation as a whole. The actual number of unemployed engineers in California varies from an estimated 10,800 in 1970 by the Department of Human Resources Development to between 20,000 to 30,000 in a report prepared for the California Assembly Science and Technology Advisory Council.[5] According to the National Science Foundation, unemployment among engineers reached 5.3 percent in California in June-July, 1971.[6] Orange County and the Los Angeles-Long Beach area had unemployment rates of 7.4 and 6.6 percent respectively.[7] The *Manpower Report of the President* shows higher unemployment rates for exactly the same period; 9.0 percent in Orange County and 7.1 percent for the Los Angeles-Long Beach area.[8] This source also gives an unemployment rate of 6.6 percent for San Jose and 4.5 percent for San Diego.[9] Unemployment

TABLE 5

CONTRACT AWARDS IN CALIFORNIA
(IN MILLIONS)

Fiscal Year	DOD	NASA	Airlines	Total
1961	$5,277	$ 900	$ 900	$6,316
1962	5,993	441	800	7,234
1963	5,836	1,098	600	7,534
1964	5,101	1,663	1,100	7,864
1965	5,154	1,876	1,200	8,230
1966	5,813	1,808	1,800	9,421
1967	6,689	1,563	2,500	10,752
1968 (peak year)	6,472	1,318	3,600	11,390
1969	6,824	1,046	2,800	10,670
1970	5,824	875	3,300	9,999
1971 (estimate)	5,000	865	2,800	8,665
1972 (estimate)	5,500	600	2,400	8,500

Source: Present and Future Technological Employment in California, A Report to the Assembly General Research Committee California Legislature, December, 1971, p. 9.

for engineers nationwide in the first part of 1971 was, by contrast, only 3.0 percent, according to both the *Manpower Report* and the National Science Foundation. It should be noted that in 1971 the national unemployment rate of engineers was about four and one-half times as high as three years earlier, according to the *Manpower Report*.[10] The National Science Foundation data show only a 1.6 unemployment rate in the spring of 1970, just one year earlier.[11] The unemployment of engineers is actually worse than the figures above indicate. Of the employed respondents in the National Science Foundation survey of engineers on which its data was based, 6.9 percent reported they were working in non-engineering positions.[12] The reasons given for accepting such positions included the lack of available engineering positions, among other things.

These data on unemployment for engineers indicate that the "rosy glow" assumptions used by the Department of Labor and adopted by the California Department of Human Resources Development to obtain the demand figure of 66,400 for engineers cannot be used as a basis for estimating the real demand.[13]

The Role of the Federal Government

In recent years, Federal and state government officials have been calling for the nation's colleges and universities to be responsive to the needs of the job market and to prepare students with marketable skills. A high official in the U.S. Office of Education, for example, has suggested a "refocusing of education to give all young people realistic preparation for the job market, whether they leave school at the minimum permissable age or go on to institutions of higher learning."[14] (Emphasis is ours.) Governor Reagan of California in a recent speech has emphasized technical and occupational training in public schools. The *Los Angeles Times* of March 23, 1972, quotes the Governor as saying: "During the recent job market slump it became obvious that our higher educational system has been able to turn out more graduates than the economy can absorb." This statement was made in the context of a speech calling for urgent educational reform. The implication appears to be that higher educational institutions have not been responsive to job market demands. The evidence in engineering does not support such a conclusion.

Our data show that it was the Federal government that provided the funds to increase the supply of engineers; it created the demand for engineers by providing funds for R & D and for the defense and aerospace industries; and it has created the current surplus of engineers by precipitously withdrawing those funds. The evidence shows that, at least in engineering, both students and educational institutions were responsive to the demand. This, of course, does not imply that in other fields of specialization higher educational institutions may not have been responsive to the job market, or that occupational training is not needed at lower levels of the educational system.

The *Manpower Report of the President* describes how the Federal government brought about the supply and demand "roller coaster" effect in engineering:[15]

> In 1962, a panel of the President's Science Advisory Committee concluded that a serious shortage of highly trained personnel existed in engineering, mathematics, and physics. It called for federally supported traineeship programs and other aid to graduate education in these fields.
>
> ... federally financed fellowships and traineeships in engineering, mathematics, and physics were increased nearly sixfold ...between 1960-61 and 1967-68.
>
> At the peak in 1967-68 and the following year, 1 out of every 6 full-time graduate students ... held a federally supported fellowship or traineeship.

At this point the Federal government began to withdraw its support in these fields.

Federal expenditures for R & D programs at colleges and universities also rose throughout this same period. It provided $405 million in 1960, $1.3 billion in 1966, and $1.6 billion in 1971.[16]

At the same time that it was pumping up the supply of engineering graduates, the Federal government was cutting back the funding for those activities that employed engineers. California, in particular, was hurt by these cutbacks. The rise and decline in Federal contract awards in California by the Department of Defense, the National Aeronautics and Space Administration and expenditures by the airlines are shown in Table 5. In response to the decline of Federal spending in aerospace and defense industries and also in response to declining expenditures for new aircraft by the airlines industry, employment of engineers reached a plateau in 1967-68 and then underwent a sharp decline throughout 1969-70 (see Table 1).

With current unemployment and falling college and university enrollments in engineering, the Federal government appears to be initiating the "roller coaster" climb once again.[17] The U.S. Department of Labor describes the new recommendations in Federal funding as they may affect the employment of engineers:[18]

> During 1971, the President directed the Domestic Council to review the adequacy of the country's R & D effort in the light of national needs. Following this review, an increase in Federal R & D funding of $1.4 billion, or 8 percent, above fiscal 1972 was provided for in the 1973 budget recommendations. This includes a rise of $700 million, or 15 percent, in civilian R & D aimed toward the solution of long-range domestic problems - with new emphasis on the fields of energy, environment, transportation, health, natural disasters, and drugs. An important innovation is a proposed experimental program of Federal incentives to increase industrial and other non-Federal investment in R & D and its applications. In addition, an increase of $700 million in defense R & D is recommended. These increases in R & D funds will assist in expanding employment opportunities for scientists and engineers for both universities and private industry.

The President's budget recommendations for 1973 were hailed by Edward E. David, Jr. in an editorial in *Science*, April 28, 1972. He describes the President's message on science and technology which went to Congress in March, 1972 containing the 1973 budget recommendations as a landmark, laying "the foundations for a coherent science policy for the United States. . .." He points out that problem-solving on the domestic front is the fastest growing component of the fiscal 1973 budget, "some 15 percent this year as opposed to a 9 percent

growth in defense R & D." David concludes that the President's message is "pro-science and pro-technology," and that the President "projects a bright future for science and technology...."

We should point out, however, that the recommended increase in financial support for domestic problem-solving, even if approved by Congress, will do little to alleviate the plight of currently unemployed aerospace defense engineers, particularly those over 40 years of age who are the largest proportion of unemployed. And the 8 percent growth from fiscal 1972 in defense R & D expenditures will compensate only to some extent for the past declines in DOD and NASA spending.

It may well be that the 1973 budget recommendations lay the foundations for a coherent science policy. But insofar as manpower supply and demand is concerned, we quote from the *Manpower Report*:[19]

> Clearly, the Federal Government needs to take into consideration the manpower implications of programs for which it is the principal supplier of funds or the primary purchaser of output. That shifts in these major Federal programs can lead directly to the employment (or unemployment) of large numbers is evident from the figures....
>
> ...the Federal Government must be particularly alert to the impact of its programming on the supply of and demand for professional manpower.

Finally, in identifying the manpower lessons of the 1960-70 decade, the *Manpower Report* states:[20]

> ...the Federal Government has been directly and indirectly responsible for large-scale fluctuations in the demand for manpower.

Other experts in the manpower field have independently reached this same conclusion. John Folger, Executive Director of the Tennessee Higher Education Commission, writes, for example, "...the important point is that governmental priorities are increasingly becoming the determinants of shifts in manpower demand."[21] And E. Wight Bakke of the National Manpower Policy Task Force has stated that the Federal government must bear a large degree of responsibility for the current unemployment and "inexcusable wastage" of human resources among the more skilled and better educated segments of the labor force.[22] He concludes that "changes in Federal policy are clearly responsible for most of the present difficulties."[23]

Our survey of the available data on manpower supply and demand for engineers and of the literature on the subject leads us to agree with this conclusion. As a result, it is difficult for anyone to estimate with any accuracy the future demand for engineers. The projections of the U.S. Department of Labor were wrong in 1969

because it could not anticipate the economic downturn and the cutbacks in aerospace/defense spending and other types of Federal expenditures that supported the employment of engineers. It now appears that such expenditures may once again begin to rise, but we cannot be sure until the Congress acts on the President's recommendations. We also cannot anticipate what will happen to such expenditures in the years beyond 1973 in the absence of a coherent and long-range Federal manpower policy for engineers.

Short-Range vs. Long-Range Supply, Demand, and Need

Two additional problems complicate any attempt to define clearly the relationship between supply and demand for engineers in California. The first pertains to the necessity to differentiate between short-range and long-range demand, and the second pertains to the need to differentiate between the terms, "demand" and "need."

Our data indicate that at least through 1975 there will continue to be a surplus of engineers in California. However, looking beyond 1975, there is disagreement among the experts in the manpower field as to whether there will be a continuing surplus or a shortage. Allan M. Cartter is one of the pessimists. In reviewing scientific manpower for the period 1970-1985 he finds a serious oversupply of Ph.D.'s in various fields. He writes:[24]

> Except for brief periods of time, and for some subspecialties we have never experienced such an overall growth rate for doctoral scientists and engineers in the past. My personal belief is that we are on a course which would result in about one-third too many Ph.D.'s produced in the latter part of this decade, and perhaps one-half too many in the 1980's, for the types of employment we have known in the past. (Emphasis in the original.)

In a similar vein, writing about the increasing number of college graduates expected in the 1970's (an anticipated 50 percent increase), the *Manpower Report* concludes[25] "In all probability, the general scarcity of professional personnel and intense demand for college graduates which prevailed during most of the 1960's have come to more than a temporary end. The unique conjunction of demand and supply factors which produced this shortage...will not recur in the foreseeable future." (Emphasis is ours.)

E. Wight Bakke disagrees with those who foresee oversupplies for scientists and engineers. He points out that future breakthroughs in science and technology cannot be predicted. He writes: "The only prediction that can be safely made on the basis of experience is that the need for scientifically trained manpower expands with every scientific discovery."[26] He notes that the projections by Cartter and the Department of Labor indicating the probability of an oversupply of Ph.D.'s in the future are based on "the types of employment we have known in the past."[27]

Betty Vetter is concerned about the long-range effect of "scare stories about unemployed scientists and engineers" in an editorial in *Science* on April 7, 1972. She notes the drop in enrollments in these fields and that this means fewer degrees will be granted in the years ahead. She then writes:

> However, the needs for technologically trained experts to meet national and social goals will not have diminished by the time these smaller classes emerge from the educational pipeline. We will still be trying to erase urban blight, produce adequate clean energy, purge the environment, create effective transportation systems, and provide adequate health care, while maintaining our national defense and continuing some level of space exploration. If the state of the economy and a reordering of national priorities has enabled us to convert these needs into demand (meaning jobs), the supply of technologically trained specialists may again be too small in a few years.

Frederick E. Terman asserts there is not a surplus of Ph.D.'s in engineering and need not be in the future.[28] The problem, he maintains, is that engineers have been trained in the past as narrow specialists; that they are not trained broadly enough to meet industry's needs and to help solve social problems. The problem is thus not one of an imbalance between supply and demand, but of "searching out new needs and hitherto neglected opportunities, and then developing the manpower markets thus defined."

The introduction of the concept of <u>need</u> as distinct from <u>demand</u> by Vetter and Terman immediately alters the notion of an oversupply of engineers or other types of professional manpower. The Staff Report of the Commission on Human Resources and Advanced Education defines the "need" for college graduates to be the numbers required to fulfill socially desirable goals.[29] Applying this concept of need, rather than demand, the Commission writes:[30]

> To a considerable extent, our concern with the adequacy of manpower supplies arises from the gap between our ideals for service and the number and quality of people who are available to provide that service. This view of our manpower problem compares the supply with the need for personnel, rather than with the demand estimated from past trends in the economy. A projection of needs, compared with available supplies...indicates a big gap between the estimated number of college-educated people our society could use, and the number of college graduates we have projected to be available in the next decade.

The Commission report, one of the most comprehensive we have reviewed for this study, goes on to point out an additional problem: "...the concept of an oversupply of college graduates lacks meaning, since as the supply of graduates grows, the standards for occupations also shift, so that some growth in demand for college-educated persons

will occur."[31]

On the subject of forecasting demand for engineers, the Commission report states:[32]

> Methods do not exist for making reliable and meaningful forecasts of demand for engineering graduates, whether long-term or short-term forecasts. If it is possible to develop such methods it will be at great cost... forecasts are heavily biased by the economic condition existing at the time they are made.

This conclusion is borne out by the Commission report itself which was written before the 1969-71 recession and which predicts shortages of engineers.

The *Manpower Report* is optimistic about the requirements for engineers in the long run. This optimism "derives from the crucial role of these professions (science and engineering) in scientific and technological progress essential to the country's economic well-being, to the solution of its domestic problems, and to the national defense."[33]

The *Manpower Report* finally concludes that the recent weakening in the demand for scientists and engineers is only a temporary condition that will be changed with an acceleration in business activity. The report states:[34]

> ...during the 1970's as a whole, sustained economic and employment growth in the country generally will almost certainly entail enlarged demand for scientists and engineers, though the rate of increase in their employment is likely to be slower than the forced-draft expansion of the 1960's.

Conclusions

All long-range forecasters dealing with the period from the present to the year 2000 whose work we have examined anticipate continuing growth in the demand for scientists and engineers.[35] According to such scholars and experts as Daniel Bell, John Kenneth Galbraith, Derek J. de Solla Price, Peter Drucker, Herman Kahn, John McHale, Kenneth Boulding, Burnham Beckwith, et al., the United States is becoming a "postindustrial society" characterized by the continuing growth in the amount of knowledge (at an exponential rate), the increasing importance of education, and increasing requirements for professionalization. Knowledge and service workers will gradually replace blue-collar and production workers in such a society. The knowledge industries will grow in importance relative to the traditional production industries. In such a society, education increasingly becomes the key to social mobility and enhances the employability of the individual. Over the long term, such a society will have a steadily growing demand for professional, technical, and kindred workers, including engineers.

If these scholars and experts are correct in their assumptions about the direction of our society, and we believe they are, action should be taken by both state and Federal authorities to provide continuing support for engineering students but only in the context of a long-range manpower policy, preferably covering the years from 1975 through 2000. Action is immediately needed to counteract the apparently waning interest of young people in career fields related to technology such as engineering. We believe that young people will be attracted to engineering once again if it is made clear by state and Federal authorities that technology will be used to solve pressing human, social, and national problems in such areas as environmental pollution, housing, transportation, clean energy sources, and so on.

A major problem we have found in this study of engineering is the apparent over-reaction by both students and government officials to short-range fluctuations in supply and demand factors. As we have seen, student enrollments appear to reflect current manpower surpluses. Government officials are suggesting basic changes in educational practices based on a current manpower surplus and they have acted in the past based on a then-existing manpower shortage. The use of the U.S. Bureau of the Census data in supply and demand studies usually results in analyses spanning only one decade or even shorter periods of time for which data happens to be available. Overreactions are inevitable when the time span considered is a decade or less and when manpower data is limited to a comparable time period.

The relationship between supply and demand in engineering in this study illustrates the well-known problem in the systems field of over-compensation resulting in oscillations.[36] Oscillations occur in heating systems, in the profit and loss of a corporation, and in the economy of a country. To prevent oscillations, some form of "feedback" control mechanism is required, as in the case of the thermostat in heating systems. The purpose of the thermostat is to collect information pertaining to deviations of the system from a pre-specified temperature and then to turn the system "on" or "off." Today, in manufacturing, computers are being used successfully to prevent excessive oscillations in inventory control. The problem in education is that there is a time discrepancy between the sensing of a condition, such as a manpower surplus, and the initiation of corrective action, such as the curtailment of a Ph.D. program in the surplus field. The decline in student enrollment in engineering may make sense in terms of current job market conditions, but may not make sense in terms of future demands. The students in professional programs need information about the future, not about the present. To eliminate such time discrepancies, educational systems must develop better mechanisms for:

1. detecting both present and future demands and needs;
2. detecting deviations (a shortage or a surplus) from a desired condition through timely collection of essential data;
3. comparing the collected data with pre-established

objectives; and

4. taking corrective action to eliminate undesirable oscillations in manpower supply and establish stable production of required manpower in relation to a long-range plan.

While education is a much more complex system than a manufacturing process, there is much that could be done to decrease the oscillations we have found to exist in the field of engineering. We shall make some recommendations along these lines in the final section of this report.

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B. CHEMISTRY

Introduction

Analysis of the supply and demand relationship in chemistry is important because the field is the largest of the physical sciences in terms of employment and the physical sciences are the foundations of our technological and industrial society. The economic well-being of the nation depends upon the continuing creation of a supply of competent scientists adequate to meet all possible demands. Also, as the *Manpower Report of the President* points out, the nation "has a heavy investment in the education of its professional workers, and any underutilization of their talents and training represents a national loss."[1]

In view of the heavy dependence of our society upon science and technology, we might expect that the physical sciences would be increasing more rapidly than the humanities or social sciences. From 1955 to 1959, mathematics and the physical sciences did have the highest rate of growth, but during the period from 1960 to 1965 the physical sciences only grew about 35 percent while the biological sciences (excluding the health professions) rose about 45 percent and both the humanities and the social sciences increased about 70 percent.[2]

More recent data available from the National Science Foundation show ominous signs. The Foundation reports that enrollments and degrees in the physical sciences are lagging behind other fields of study.[3] Relative interest in science has been steadily declining. Among all enrollments, the physical sciences have declined from 8 percent to 5 percent of the total from 1960 to 1970.[4] And in chemistry, there were 3 percent fewer graduate students enrolled in 1970 than in 1967.[5] The U.S. Department of Labor in its bulletin, *College Educated Workers, 1968-80,* published in 1970, concludes that "based on past patterns of study and entry to the profession, the supply of chemists is expected to fall short of demand."[6]

The most recent data available on student enrollment in chemistry indicate a dramatic turnabout in student interests. It is essential to determine the extent of this change since the long-range interests of California and the nation are dependent in large measure on the results.

California Supply of Chemists

The actual and estimated supply of chemists with baccalaureate, Master's, and Ph.D. degrees produced by the independent colleges and universities, the California State University and Colleges, and the University of California for the academic years 1967-68 through 1970-71 is shown in Table 6. The table does not include data on associate degrees awarded by the community colleges. Information on graduates with chemistry majors were not available from the community colleges since these colleges aggregate graduates by student-declared majors in a broad category called "Natural Science and Mathematics."

TABLE 6

SUPPLY OF CHEMISTS, ALL DEGREES, UNIVERSITY OF CALIFORNIA, STATE UNIVERSITY AND COLLEGES, AND INDEPENDENT COLLEGES AND UNIVERSITIES, ACTUAL AND ESTIMATED

1967-68 THROUGH 1970-71

Academic Year	Independent Colleges and Universities	Net Change	% Change	State Univ. and Colleges	Net Change	% Change	Univ. of Calif.	Net Change	% Change	Total Degrees	Net Change	% Change
1967-68	211*			291			348			850*		
1968-69	321*	110*	52.1*	358	67	23.0	500	152	43.7	1,179*	329*	38.7*
1969-70	272	-49*	-15.3*	320	-38	-10.6	441	-59	-11.8	1,033	-146	-12.4
1970-71	238	-34	-12.5	316	-4	-1.3	510	69	15.6	1,064	31	3.0
									Grand Total	4,126*		
Three year change:		27*	12.8*		25	8.6		162	46.6		214*	25.2*

Source: Actual degree data provided by University of California, Office of Analytical Studies; California State University and Colleges, Office of Institutional Research; and Independent Association of California Colleges and Universities.

*Note: Estimated degree data based on averages of actual degree data provided by the above three segments of higher education in California as described in the text.

As in the case of engineering, degrees awarded by the independent colleges and universities were not available for academic years 1967-68 and 1968-69. To obtain estimates for these years, we used the same assumptions and procedures that were used in estimating engineering degrees. Therefore, the figure 321 for degrees produced by the independent colleges and universities in 1968-69 is based on the average decrease of 49 degrees awarded by the State universities and colleges and the University of California for the academic years 1968-69 and 1969-70. The figure of 211 degrees awarded in 1967-68 is based on the average increase of 110 degrees produced by the State universities and colleges and the University of California for the academic years 1967-68 and 1968-69. The sum of all degrees awarded by each of the segments, both actual and estimated, shown in Table 6 from 1967-68 through 1970-71, is 4,126.

Unlike engineering degrees which show increases each year from 1967-68 through 1970-71, although at a declining rate, the degrees awarded in chemistry, as shown in Table 6, reached a peak in 1968-69, declined in 1969-70, and then rose slightly again in 1970-71. The net change over the four-year period is an increase of 25.2 percent. It should be noted, however, that the trend in degrees awarded is down at both the independent colleges and universities and the State universities and colleges from the peak year, but with an increase of 15.6 percent in 1970-71 at the University of California. Thus, we have no clear trend in degrees awarded in chemistry for the three segments for which we have data.

We turn now to the problem of estimating degree production in chemistry for academic years 1971-72 through 1974-75. As we have noted, there is no clearcut trend that can be extrapolated from the degree data. However, unlike the evidence of declining enrollment in engineering, in chemistry there is evidence of a sudden increase in enrollment (see Table 7). We shall look first at the national scene and then at available data on California.

Writing in *Science* about national data, Betty Vetter states that "in the physical sciences, the number of bachelor's degrees in chemistry dropped in 1970 from the previous year and is expected to stay about level through 1972. Unexpectedly large enrollment in first-year and organic chemistry in the fall of 1971 may raise the number of baccalaureate degrees by 1974." (Emphasis is ours.) By contrast, enrollment in physics began dropping in 1969-70 and has continued to decline since.

The unexpected increase in enrollment in chemistry courses has apparently also occurred in California, but as early as 1970. Available data on two major west coast universities, the University of California at Berkeley and Stanford University show record enrollment in freshman chemistry.[8] At Berkeley in 1971, more than 1,600 students applied to enter the first part of the freshman general chemistry course, almost double the number in the fall of 1969. The increase in enrollment in this course from 1969 through 1971 is shown in Table 7.[9]

TABLE 7

ENROLLMENT IN FRESHMAN GENERAL CHEMISTRY,
UNIVERSITY OF CALIFORNIA, BERKELEY

1969-71

Year (Fall quarter)	Enrollment	Net Change	% Change
1969	850		
1970	1,150	300	35.3
1971	1,600	450	39.1
	Two year change:	750	88.2

At Stanford University the rise in enrollment is equally startling. The first year course in chemistry has had a 90 percent increase in the past two years.[10] Stanford also reports that the new interest in chemistry is being sustained since student enrollment in second year courses are proportionate to those in the beginning courses last year. As to the reasons for the sudden increase in chemistry enrollment and sustained interest, Stanford University officials have speculated that the rise was due to an increased interest by students in environmental problems and in pre-medical work.[11]

Students at the California State University and Colleges are also showing increasing interest in chemistry from academic year 1967-68 through 1971-72. The enrollment data in Table 8 indicate a substantial increase in undergraduate enrollment in 1968-69. This is followed by a continuing increase in graduate enrollment beginning in the following year and continuing through 1971-72. Overall, enrollment begins to climb in 1970-71. For the five-year period from 1967-68 to 1971-72, enrollment is up a significant 32.1 percent despite a slight drop in 1969-70. The grand total for enrollment for the five-year period is 10,028.

To project the total undergraduate and graduate degrees to be awarded in chemistry for all California institutions of higher education, we shall use what would appear to be a conservative rate of increase, the 32.1 percent rise in total enrollment at the State universities and colleges during the academic years 1968-69 through 1971-72. These students would receive their degrees between 1971-72 and 1974-75. A 32.1 percent increase above the 4,126 degrees awarded from 1967-68 through 1970-71 would be 1,324 additional degrees or a total of 5,450. If we use a less conservative rate of increase at a mid-point between the increases at the State universities and colleges,

TABLE 8

ENROLLMENT IN UNDERGRADUATE AND GRADUATE CHEMISTRY COURSES,
CALIFORNIA STATE UNIVERSITY AND COLLEGES,

1967-68 THROUGH 1971-72

Academic Year	Under-graduate	Net Change	% Change	Graduate	Net Change	% Change	Total	Net Change	% Change
1967-68	1,521			213			1,734		
1968-69	1,808	287	18.9	204	-9	-4.2	2,012	278	16.0
1969-70	1,723	-85	-4.7	215	11	5.4	1,938	-74	-3.7
1970-71	1,778	55	3.2	275	60	27.9	2,053	115	5.9
1971-72	1,951	173	9.7	340	65	23.6	2,291	238	11.6
						Grand Total	10,028		
Four year change:		430	28.3		127	59.6		557	32.1

Source: Office of the Chancellor, California State University and Colleges, April 26, 1972.

the University, and the independent colleges and universities, let us say 60 percent, the increase above 4,126 degrees would be 2,476 additional degrees or a total of 6,602 degrees.

The grand total of all degrees produced in chemistry for the three segments of higher education in California for the academic years 1967-68 through 1974-75 for the first alternative projection would therefore be 9,576 and 10,728 for the second alternative. These figures are obtained by adding the projected numbers of degrees for 1971-72 through 1974-75 to those already granted or estimated from 1967-68 through 1970-71.

California Demand for Chemists

The demand for chemists from 1968 to 1975 estimated in *California Manpower Needs to 1975* is 5,400, including 4,200 for new jobs created by industrial expansion and 1,200 replacements due to deaths and retirements.[12] If we compare our two alternative estimates of degree production of 9,576 and 10,728 for the same period of time, 1968-1975, we have a surplus of 4,176 for the first alternative and a surplus of 5,328 for the second.

There are two major difficulties with these figures. The first is that the demand estimate of 5,400 may be too high because it is based on the U.S. Department of Labor's "rosy glow" assumptions that have proven to be erroneous, as discussed in our previous section on engineering. Based on those assumptions, the Department of Labor has concluded that the supply of chemists would be below requirements through 1980.[13]

The second problem pertains to the real meaning of enrollments in chemistry classes and the relationship of such enrollments to degrees in chemistry. In the case of engineering there is no problem relating the two factors. In the case of chemistry, the surpluses noted above may be spurious to the extent that students enrolling in chemistry courses may not be planning to become chemists. Unfortunately, we have no data on the long-range objectives of students currently enrolling in chemistry classes. We do not know what proportion are interested in traditional occupations in chemistry, what proportion are preparing for careers in the health professions, and what proportion are interested in new fields such as environmental problems and pollution.

However, even if we assume that one-half of our estimated numbers of graduating students from 1971-72 through 1974-75 for both projections are planning to enter the health professions and not chemistry, we would have 6,851 degrees in chemistry for the first alternative for the period from 1968 through 1975 and 7,427 for the second. If, therefore, the Department of Labor's demand estimate of 5,400 is correct, there would still be a surplus of chemists, 1,451 in the first case and 2,027 in the second. If the demand estimate is too high, due to the "rosy glow" assumptions, the surplus of chemists would be even larger.

Problems in Estimating Supply and Demand for Chemists

We have already touched upon the unexpected increase in enrollment in chemistry courses which may affect the supply of chemists and upon the unreliability of demand estimates projected through 1975. The relationship between supply and demand for chemists may be brought into sharper focus by reviewing: (1) unemployment in chemistry; (2) the responsiveness of students to the job market; and (3) the academic demand for chemists.

Unemployment in Chemistry

The unemployment situation in chemistry may be indicated by the fact that the American Chemical Society (ACS) is asking each of its 100,000 members to donate a minimum of ten dollars to a new "emergency" fund to alleviate unemployment among the nation's chemists.[14] The ACS reports that 3,000 of its members are unemployed and another 6,000 "malemployed."[15] It also reports that June graduates are having more difficulty finding jobs this year than last year.

In a National Science Foundation (NSF) survey, scientists at the national level reported an unemployment rate of 2.6 percent for Spring, 1971, as compared with 1.5 percent in the spring of 1970.[16] For the field of chemistry, the NSF data show an unemployment rate of 3.0 percent nationally and 3.8 percent in California.[17] Approximately 42 percent of all the unemployed scientists, including chemists, were located in California.[18]

According to the annual 1971 starting salary survey made by David Roethel and Charles R. Counts for the ACS, unemployment is at an all time high for recent graduates in chemistry and chemical engineering.[19] The survey finds that one in four 1971 chemistry graduates found full-time employment, thus the situation was worse than in 1970 when two out of five graduates had jobs. Unemployment among the 1971 chemistry graduates doubled from 5.1 percent in 1970 to 10.3 percent in 1971. For holders of the bachelor's degree, unemployment reached 11.6 percent. One might expect that such unemployment rates would turn students away from chemistry.

Responsiveness of Students to the Job Market

The evidence on unemployment in chemistry is clearcut. It is similar to unemployment in engineering. But while students have shown declining interest in engineering, as reported in the previous section, and appear to be responding to the job market situation, they are reacting differently in the case of chemistry. Not only are they not responding to unemployment news, they are enrolling in chemistry courses in record numbers.

There are two ways to interpret the students' behavior. We can speculate on the one hand that they <u>are</u> being responsive to the job market by taking chemistry courses as part of their career planning to enter the health professions where unemployment does not exist. We

can also speculate that the students are entering the field of chemistry not because of current or past job market considerations, but because of their concern with environmental and pollution problems and their anticipation of future job opportunities in these areas. Clearly, however, without a specific investigation of student motivations and educational objectives, we can only speculate about these matters.

Academic Demand for Chemists

Unlike engineers who are largely employed in industry or other nonacademic jobs, a large proportion of chemists become teachers at colleges and universities, particularly those with Ph.D. degree. Frederick E. Terman, for example, states that in the physical sciences (physics and chemistry), 40 percent of employed Ph.D.'s in 1968 were employed by universities and 49 percent were working in nonuniversity institutions, with 11 percent listed as "other."[20] These data indicate that the rate of employment in the academic world is critical for the total demand for chemists. If both academic demand and non-academic demand were to decline simultaneously, this would create a severe surplus of chemists.

Allan Cartter provides data on new chemistry faculty demand and estimated new doctorates available, actual and projected, from 1965 through 1985.[21] These data are shown in Table 9.

Column "A" in the table shows total new faculty needed and column "B" shows the number of Ph.D.'s required to maintain the existing proportion of Ph.D.'s to non-Ph.D.'s (70 percent of "A"). The projections for new Ph.D.'s shown in the columns under "C" are derived from three different sources: the National Research Council, the Office of Education, and Allan M. Cartter's own data. Column "D" expresses total doctorates for each of the projections as a multiple of the number required to maintain existing quality of faculty.

Insofar as academic employment for chemists is concerned, Cartter reaches a discouraging conclusion. He states that the data show:[22]

> a discouragingly consistent pattern. For chemistry...in the mid-1960's, slightly over a third of new Ph.D.'s had to enter college teaching to maintain a constant level of quality....Today (1971) a quarter or less are needed in teaching positions. This fraction is likely to drop further by 1975, and then decline more speedily as the 1980's approach. In the first half of the 1980's, it is quite possible that no new college teachers would be needed.... (Emphasis in the original.)

The reason for this situation is the decline in total college enrollment due to demographic factors.

We should note, however, that the picture presented by Cartter

TABLE 9

NEW FACULTY DEMAND AND NEW DOCTORATES AVAILABLE FOR CHEMISTRY, ACTUAL AND PROJECTED

1965-1985

Year	New faculty needed A 3-Year average	B With Ph.D. (70% of A)	C New Ph.D's NRC	OE	AMC	D Ratio C:B NRC	OE	AMC
1965	722	505	1,439	1,439	1,439	2.9	2.9	2.9
1970	703	492	2,033	1,938	2,030	4.1	3.9	4.1
1975	825	578	2,884	2,724	2,290	5.0	4.7	4.0
1980	678	475	4,273	3,153	2,888	9.0	6.6	6.1
1985	-53	-37	n.a.	n.a.	n.a.			

Notes: NRC = National Research Council; OE = Office of Education; AMC = Allan M. Cartter; n.a. = not available

Adapted from: Allan M. Cartter, "Scientific Manpower for 1970-1985," Science, Vol. 172, No. 3979, April 9, 1971, Table 4, p. 136.

may not be as discouraging as it appears since actual enrollments in college are higher than he projects. For example, he estimates 9,539,000 full-time equivalent students enrolled in 1980 as contrasted with 6,303,000 in 1970.[23] But total enrollments at all colleges and universities had already reached 9,000,000 in the fall of 1971.[24] Also, if student interest in chemistry is increasing as our data indicate, the demand for chemistry professors will also increase.

On balance, we would conclude that the academic demand for chemistry professors and instructors through 1975 will not be as large as the supply of new Ph.D.'s and the situation may become worse past 1975 through 1980, but the oversupply may not be as large as Cartter anticipates.

Conclusions

The conclusions we reached in the previous section on engineering apply here as well. As we stated, over the long-term a postindustrial society will have a steadily growing demand for professional, technical, and kindred workers. However, in contrast to engineering where student interest appears to be waning, there has been a sudden surge of student interest in chemistry. If this interest reflects a trend, it could

result in a serious surplus of chemists during the period from the present through 1975 and a greater surplus beyond 1975. We may hope that these students are responding to information about current unemployment in chemistry and are taking chemistry courses in preparation for careers in medicine and other health-related professions.

Clearly in a situation of possible manpower surpluses, we should not be left merely to "hope" about the career objectives of students. They should be receiving information from their institutions about the employment possibilities in the fields they have chosen. They should be informed when unemployment in their field is prevalent. And, at the same time, the institutions need to have information about the career plans of their students. The proportion of students studying chemistry who plan to go on to the health professions should not be a matter of guesswork if educational planning is to be more than just an expression.

There remain the questions of the long-range job market for chemists in our society, as well as the immediate problem of unemployment, and the relationship between the need for chemists as distinct from demand. We would agree with E. Wight Bakke and others who contend that we cannot base the future demand for chemists on their past employment. Chemistry is one of those fields in which major scientific breakthroughs may occur at any time.[25] Peter F. Drucker notes in his book, *The Age of Discontinuity,* for example, that the pharmaceutical field is a new growth industry.[26] He writes: "Thanks to new drugs, health care has become the 'best buy' on the market and a universal demand...Yet economically - that is, in terms of employment or of direct contribution to national product - the pharmaceutical industry is still hardly visible to the naked eye...."[27] We cannot estimate the extent of the demand for chemists that the pharmaceutical industry or other new fields will create in the next decade.

The "roller coaster" effect of the government's role in the employment of engineers has been discussed earlier. Any anticipated surplus among chemists in the future, as in the case of engineers, will depend, as John Folger points out, on policy decisions made by the government. He writes, "...the Congress could easily create a new manpower shortage overnight by setting a short timetable for a big public expenditure for some complex new national objective."[28] Some of the areas where the government might attempt this, Folger notes, include the elimination of pollution, exploration of the oceans, development of high-quality mass transportation, improvements in health delivery systems, housing, and the reduction of crime.[29]

In light of the uncertainties that lie ahead, it would be wise to recognize the difficulties inherent in trying to prevent occasional shortages or surpluses of manpower in various occupations. In a society that is changing so rapidly that its psychological effects are being described in books like *Future Shock,*[30] the best one can hope for is an approximate match between degrees and jobs.[31]

This does not mean that nothing can or should be done. On the contrary. Let us first state what, in our judgment, would be unwise to do. Simply limiting enrollments in a field like chemistry where a surplus may currently exist does not seem to be a satisfactory solution. Likewise, an over-emphasis on career education would probably also be a mistake. Who shall be responsible for identifying the occupations of the future for young people to pursue? No such capability now exists, although institutions are beginning to appear that study the future. To prepare graduates of higher education only for careers that have been identified in the past would, in our view, be an erroneous interpretation of the history of our society. It is not static and unchanging. Its basic characteristics are its dynamism, its high rate of change and, perhaps most importantly, the capacity of its people and institutions to adjust to change.

Under these conditions and for such a society, the objective of educational programs in scientific fields such as chemistry should be flexibility, generality, and the careful avoidance of excessive specialization. In this respect, the academicians may have done a disservice to their students in recent years. As Frederick E. Terman points out, the primary markets for new Ph.D.'s in the future will no longer be academic institutions but applied research in industry.[32] Educational programs should change to reflect this new orientation. From this perspective, changes in the content of higher-level educational programs may be more essential than changes in the numbers of students who are graduated in a field.

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C. LAW

Introduction

In California, as well as nationally, there is considerable evidence that during the 1970-1980 time period we may be facing serious legal manpower supply and demand imbalances that could equal, if not surpass, those now existing in the aerospace and defense industry and the teaching profession. At its recent annual meeting, the American Bar Association (ABA) noted that the nation's 147 approved law schools are now graduating students at more than twice the 1960 rate, an annual rate that is estimated to reach almost 30,000 by 1974 and accelerate, which will approximately double the legal profession by 1985.[1]

With the number of students in this year's freshman law class twice as high as the projected number of new jobs awaiting them, the Association forecast possible economic distress in the years ahead. Serious concern over U. S. Department of Labor estimates of average annual openings of 14,500 for lawyers until 1980 prompted the Association to seek remedies.[2] Calling the present situation a "potential social tinderbox," Robert W. Meserve, president-elect of the ABA, expressed concern that thousands of disappointed students, trained in law skills and unable to find employment, might turn against the "system," and announced the formation of a special nine-member American Bar Association Task Force on Professional Utilization. This group will study the impact on the public and the legal profession of the mushrooming numbers of students to be admitted to the practice of law. They will also consider the development of such embryonic specialties as environmental and consumer law, as well as new roles for lawyers in business and public administration.

Student Interest in Legal Education

Last year a study of enrollment in the 147 law schools approved by the American Bar Association was made by its Section of Legal Education and Admissions to the Bar.[3] Table 10 shows that total enrollment in approved law schools rose to 94,468 in the fall of 1971, up 11,969 from the 1970 total of 82,499, or an increase of 14.5 percent. Although not shown in the table, the number of Juris Doctor (J.D.)/Bachelor of Law (LL.B.) candidates rose from 78,922 to 91,200 during the year 1971-72; this increase of 12,278 represents an increase of 15.5 percent. The great bulk of the growth occurred in the second and third year classes. They increased 11,208 up from 41,336 in 1970 to 52,544 in 1971. The large entering classes of 1969 and 1970 account for this. Table 10 shows that the first year class this fall grew only 1,458 or 4.2 percent, a rise from 34,713 in 1970 to 36,171 in 1971. It also reflects the fact that there were virtually no "unfilled seats" in last fall's entering class.

As shown in Table 10, the last decade has witnessed a remarkable growth in law school enrollment, more than doubling from the 41,499 students in 1961 to 94,468 in 1971. First year enrollment shows a

growth pattern of 16,489 to 36,171 during this period, an increase of 119.4 percent. The number of women students enrolled this past fall was over six times greater than in 1961, having increased from 1,497 to 8,914. Table 10 shows that the major part of these increases have occurred during the past three years. It also shows that from 1966-1968 the entering classes of all approved ABA schools averaged 24,000 per year and total enrollment averaged approximately 64,000. In the fall of 1970, the entering classes totalled 34,713 and the total enrollment was 82,499.

TABLE 10

LEGAL EDUCATION AND BAR ADMISSION STATISTICS

1961-1971

Year	Enrollment Total	Enrollment Women	1st Year	LSAT Candidates	J.D./LL.B. Awarded	New Admissions to the bar
1961	41,499	1,497	16,489	23,099	9,435	10,729
1962	44,805	1,575	18,346	26,279	9,260	10,7[illegible]
1963	49,552	1,883	20,776	30,528	9,638	10,788
1964	54,265	2,183	22,753	37,598	10,491	12,023
1965	59,744	2,537	24,167	39,406	11,507	13,109
1966	62,556	2,678	24,077	44,905	13,115	14,644
1967	64,406	2,906	24,267	47,110	14,738	16,007
1968	62,779	3,704	23,652	49,756	16,077	17,764
1969	68,386	4,715	29,128	59,050	16,733	19,123
1970*	82,499	7,031	34,713	74,092	17,183	17,922
1971	94,468	8,914	36,171	107,479	17,006	

Notes: Enrollment is that in ABA approved schools as of October 1, 1971. The 1970 enrollment and degrees awarded figures are different from those published in the 1970 Review of Legal Education; the data received from the University of Puerto Rico has been included here. The LSAT candidates' volume is given for the test year ending in the year stated, thus, 107,479 administrations of the LSAT occurred in the test year July 1970 through April 1971; J.D./LL.B. degrees are those awarded by ABA approved schools for the academic year ending in the year stated; thus, 9,435 degrees were awarded in the year beginning with the fall 1960 term and ending with the summer 1961 term. Total new admissions to the bar are for the calendar year and included those admitted by office study, diploma privilege, and examination and study at an unapproved law school; but the great bulk of those admitted graduated from approved schools.

Evening Enrollment

While total law school enrollment more than doubled, evening enrollment grew 58.7 percent from 12,031 in 1961 to 19,099 in 1971. Total evening enrollment this past fall was 5.3 percent greater than last year; the evening first year class of 6,934 was 4.7 percent

greater than last year's class of 6,622. A new development, according to the American Bar's Section of Legal Education and Admissions to the Bar, has been the enrollment of a significant fraction of students who wanted to be in the full-time day program. When they lost the competition for seats in the day class, they sought and gained admission to the evening program where the competition was not quite as brisk.[4]

Applicant Volume

National student interest in legal education continues to grow at an unprecedented rate. The best index of the number of applicants to law school is the number of individual candidates for the Law School Admission Test (LSAT), a prerequisite for admission in practically all law schools. Table 10 shows that the candidate volume for the 1971 test year, July 1970 through April, 1971 was about five times greater than that in 1961. During the past three years there have been unusual increases in candidate volume; the table shows increases of 18.7 percent, 25.5 percent and 45 percent in the test years 1969, 1970, and 1971, respectively. It now seems that the number of applicants for admission to the fall entering class of 1972 will again be substantially larger. The candidate volume for the October and December, 1971 tests is 45 percent greater than a year ago; however, the increase for the 1972 test year is expected to be about 30 percent, with a total of 137,500.[5]

The American Bar's Section of Legal Education and Admissions to the Bar points out that this great increase is occurring at a time when the law schools are filled to capacity. The fall 1970 ABA Questionnaire asked the law schools for the number of additional students they would have enrolled in their fall, 1970 entering classes if additional qualified applicants made timely application. Only 16 of the 140 responding law schools (from the 146 ABA approved schools) reported that they would have taken additional students. These 16 schools could have enrolled an additional 353 day students and 306 evening students. These 659 "unfilled seats" represented less than 2 percent of the fall 1970 first year enrollment. This fall only three schools reported that they had "unfilled seats." There were 52 spaces in day programs and 35 in the evening. These 87 places represent .2 percent of the fall first year enrollment. Quite obviously, the nation's approved law schools are filled to capacity.[6]

As examples of student interest, it should be noted that the School of Law on the Berkeley campus admitted 275 students from 3,700 applicants in September, 1970. The Dean of the School estimated that a large proportion of the unsuccessful applicants would have been qualified to undertake the study of law in a first-rate law school.[7] The picture is similar in the other University of California law schools, and in virtually all accredited law schools in the State and in the nation as a whole. Harvard, for example, is reported to be receiving 8,000 applications each year for 500 openings. For the September, 1971 class, Georgetown Law School had 3,578 applicants for 600 places; Cornell had 160 places for 2,100 applicants; and Indiana University had 1,200 applicants for 400 places.[8]

Student interest in legal education in Pennsylvania is typical. In the period from 1964-69, student applications for admission to Pennsylvania law schools increased from 3,701 to 7,127, an increase of 93 percent. But in the same period, admissions increased from 996 to 1,353, an increase of only 36 percent. When one considers that these applicants had attained a bachelor's degree and passed the Law School Admission Test, it is clear that the present law school system is not satisfying a large student demand for legal education.[9]

Student Aspirations

What are the reasons for these startling increases in student interest? Is it the television-enhanced image of the glamorous young lawyer; idealistic, modish, prosperous and working for social change within the "system?" Perhaps, but the reasons are more likely to be a combination of other, more significant factors. As Dean Murray L. Schwartz of the UCLA Law School points out:[10]

> There are probably several reasons, including the unusually large number and percentage of the age group that is graduating from college; returning veterans, the opening of law schools to minority students, a group that had previously been almost non-represented; the tripling of the number of women students in these past recent years, a rate of increase that is likely to continue before it levels off; and the shift from other graduate, Ph.D. and professional programs to law schools because of the decline of job opportunities. Particularly significant in terms of the "generation gap" is the view of many college students that law is "where it's at;" lawyers are in the best position to effect needed change in our society, a view that the movements and developments of the 1960's nurtured.

Other observers of the spiraling demand for legal education feel that young people are attracted by the public image of the importance of lawyers in national and state affairs. They see the predominance of lawyers in Congress, in State government, in Presidential campaigns, and in key positions in the "establishment." And youthful idealism no doubt sees law as a means to orderly social change. Older students, drawn from public school teachers, social workers, engineers, and other professions, are also being attracted in increasing numbers. Some are no doubt seeking retraining from economic necessity; but most are probably seeking more challenging careers.[11] For example, an M.D. from UCLA leads his law school class at the University or San Diego, preparing for a career in government service dealing with medico-legal problems. A Ph.D. in biophysics from Berkeley teaches biology and public health at Harvard, doing research in pesticides while she attends the law school preparing for a career in pollution control.[12]

Finally, for those students whose motivation may be more attuned to the economics of a legal education, Table 11 figures indicate the 1967-1968 average income of lawyers as compared with other professional groups.[13]

TABLE 11

LAWYER AVERAGE INCOME COMPARED WITH OTHER PROFESSIONAL GROUPS

	Individuals	Partnerships	
	1967	1967	1968
Physicians	$27,208	$36,143	$36,250
Lawyers	10,850	25,280	26,419
Dentists	19,805	21,886	17,541
Architects	9,183	15,604	16,008

Source: Legal Economic News, American Bar Association, Chicago, Illinois, March, 1971.

In 1968 lawyers in law firms ranked second only to physicians in average income; lawyers in individual practice ranked in third place in 1967.

Whatever the reasons, there was one law student for every four lawyers in the United States in 1969-1970. By 1971-1972, that figure will be approximately one student for every three lawyers. Put another way, in 1960 the number of new lawyers admitted to the Bar was about 10,000. According to the American Bar Association, there were an estimated 342,935 lawyers in the United States in 1971. New admissions to the Bar as shown in Table 10, have grown 67 percent from 1961 to 1970 (1971 figures are not yet available), from 10,729 to 17,922. The first degrees in law awarded by approved schools have increased 80.2 percent from 1961 to 1971, from 9,435 to 17,006. An extrapolation of these figures suggests that there will be 23,000 new admissions to the Bar in 1972; 27,000 in 1973; and 29,000 in 1974. The number of lawyers in 1971 probably will double before 1985.

California Student Interest in Legal Education

Table 12 shows the first year and total enrollment in California for all seventeen ABA approved and State accredited law schools during

the 1968-1971 time period. These schools include the four University of California law schools (Berkeley, Los Angeles, Davis, and Hastings) and the ten private law schools (Loyola, University of Southern California, University of San Diego, California Western University, University of Santa Clara, University of San Francisco, Stanford, Golden Gate College, University of the Pacific (McGeorge School of Law), and Southwestern University. The three State accredited law schools listed in Table 12 are Pepperdine University (Santa Ana), Beverly College (Los Angeles), and San Francisco Law School.

An examination of Table 12 reveals the same rapidly increasing and remarkable growth in California student interest in legal education noted previously on the national scene. The fourteen ABA approved law schools, combined with the three State accredited schools, enrolled a total of 10,073 students in fall, 1970, of whom 4,469 were in the first year class. This represents a numerical increase in total enrollment from the fall of 1969 (7,905) of 2,168 students, or 27.4 percent. The first year class increase during the same two years (1969-1970) was 943 students (3,526 to 4,469), a rise of 26.7 percent.

In the fall 1971 total law school enrollment, there was a less rapid increase, since the law schools are now reported to be operating at full capacity. Nevertheless, total enrollment rose from 10,073 to 11,849, an increase of 1,776 students, or 17.6 percent; first year class enrollment went from 4,469 in 1979 to 4,853 in 1971, or 384 students, representing an increase of 8.6 percent.

The overall three year change shown in Table 12 indicates total law school enrollment increased by 5,413 students, or 84.1 percent, while the first year enrollment rose 2,047, or 73 percent. This is an exceptional growth pattern in such a short time span, indicating that California students' interest in law are following national trends to a substantial degree.

Enrollment Expansion

Further examination of Table 12 reveals that the largest expansion in legal education during the past three years has occurred in the law schools of the private colleges and universities. The three year numerical increase in total enrollment, from 3,669 in 1968 to 7,081 in 1971 was 3,412 students, or 93.0 percent, which is slightly higher than the aggregate increase of 84.1 percent for all the law schools during this period. In terms of first year enrollment, the three year change in the private colleges and universities is equally impressive, rising from 1,649 in 1968 to 2,987, an increase of 1,338 students, or 81.1 percent.

The most significant year, in terms of large enrollment increases in the private law schools, was from 1969 to 1970. Total enrollment increased from 4,079 to 5,905, representing 1,826 additional students or 44.8 percent. First year enrollment increases were 929 students,

TABLE 12

FIRST YEAR AND TOTAL ENROLLMENT IN APPROVED CALIFORNIA LAW SCHOOLS

1968-1971

Year	University of California (4)		Private Colleges and Universities (10)		Schools Accredited by California Committee of Bar Examiners (3)		Totals	
	First Year	Total	First Year	Total	First Year	Total	First Year	Total
1968	1,157	2,767	1,649	3,669	-	-	2,806	6,436
1969	1,299	3,037	1,889	4,079	338	789	3,526	7,905
1970	1,285	3,498	2,818	5,905	366	670	4,469	10,073
1971	1,417	3,851	2,987	7,081	449	917	4,853	11,849

Three year change: 1968-1971	Numerical	Percent
First Year	2,047	73.0
Total Enrollments	5,413	84.1

Source: Personal correspondence from Dean John A. Gorfinkel, Consultant to the Committe of Bar Examiners of the State Bar of California, May 16, 1972.

Notes: Enrollment figures include all first year class and total law school enrollment for the fourteen California law schools approved by the American Bar Association, and the three schools accredited by the California Committee of Bar Examiners; full and part-time students; and day and evening division law school programs. The figures in the table do not include enrollment for unaccredited law schools in California.

from 1,889 in 1969 to 2,818 in 1970, a rise of 49.2 percent. These rises were partly due to increases in first year admissions, as well as second and third years, in the approved law schools, and the ABA approval of Southwestern University (1970), and University of the Pacific (McGeorge School of Law), also in 1970. Adding to the large increases in the ten ABA private law schools in the State during 1970, were the enrollments resulting from the three newly accredited law schools (Pepperdine, Beverly College, and San Francisco).

The University of California's four law schools, always near capacity, accounted for more modest, yet significant increases in the swelling tide of law candidates. Total enrollment increases during the four years (1968-1971) were 1,084 students; from 2,767 in 1968 to 3,851 in 1971, an increase of 39.2 percent. First year expansion was 260 students; from 1,157 to 1,417, an increase of 22.5 percent.

Legal Manpower Supply in California

In estimating the total new legal manpower supply anticipated in California during the 1970-1980 time period, the first factor to be considered is the probable productivity of the existing law schools.

As we have seen in Table 12, all seventeen approved or accredited law schools in California are now operating at or near full capacity, with a total enrollment of 11,849 students. As stated earlier, the 1971 ABA survey indicated only three schools in the nation with "unfilled seats"; 52 spaces in day programs and 35 openings in the evening divisions. These three schools were not in California. In fact, many of them, at least the University of California law schools, were overenrolled during 1971 because more of the applicants who were accepted that year actually enrolled than had been the experience in earlier years. For example, last year Berkeley accepted 614 applicants to fill a class of 275. It actually enrolled 298. Including 70 special (culturally disadvantaged) "admits," of whom 62 actually enrolled, UCLA accepted 675 students to fill a class of 325, but actually enrolled 351.[14]

Total California law school enrollments are therefore likely to remain essentially the same (11,849) during 1972, and at least for the next several years, unless some new law schools open in the near future. First year enrollment will also remain approximately the same as the 1971 figure of 4,853.

The next most important factor to consider in estimating the future supply of lawyers is the number of graduates produced by the law schools in relation to those enrolled during the first year. Table 13 shows marked increases in law graduates from 1970 to 1971 in both the University of California schools and the private colleges and universities, totalling 2,006 in 1971. The three year overall rise in graduates from both segments was 628 students, or 45.6 percent. Because we have now apparently reached our total enrollment capacity, we can expect to level off in total enrollment, but not in the

number of graduates during the next several years. Because of the record first year enrollments in 1969, 1970, and 1971, the number of graduates during 1972, 1973, and 1974 can be expected to increase significantly (see Table 12).

TABLE 13

CALIFORNIA LAW SCHOOL GRADUATES

1968-1971

Category	1968	1969	1970	1971	Three Year Change Numerical	Three Year Change Percent
University of California (4)	721	741	745	960	239	33.1
Private Colleges and Universities (13)	657	702	709	1,046	389	59.2
TOTAL	1,378	1,443	1,454	2,006	628	45.6

Source: University of California, Office of Analytical Studies, and the Association of Independent California Colleges and Universities.

Notes: Graduate figures include students from all California law schools approved by either the American Bar Association or the California Committee of Bar Examiners; full and part-time students; and day and evening division law school programs. The figures do not include students who were graduated from unaccredited California law schools.

The actual and estimated production of graduates from approved law schools in California during 1968-1975 is shown in Table 14. The tabulation is based on the following assumptions:

1. The enrollment in full-time programs in law schools during 1972 will be substantially the same as the total enrollment of 11,849 in 1971. To our knowledge, no California school that did not have a three year, full-time program in 1971, has been approved for a three year program to start in 1972.

2. The total California law school first year class enrollment for each of the years from 1968-1971 is the basis for projecting graduate populations three years later. Because of the well-known and very high degree of selectivity in admissions at the more prestigious public and private California day law schools, the attrition rates have traditionally been quite low; 90% of the first year law students from

> these institutions are normally expected to graduate three years later. In many of the less prestigious day law schools, where the greatest expansion in enrollments has taken place, less selectivity has traditionally occurred and their attrition rates are therefore higher; 70% of the first year students from these institutions actually graduate three years later.[15]

Since we have been unable to determine the basis for which of the seventeen law schools should be considered "prestigious" and which "less prestigious," we have used the actual ratio of the number of graduates produced in 1971 to the number of first year students enrolled in the fall, 1968 class to derive projections for each succeeding year to 1980.

For example, in the fall of 1968, Table 12 shows a total first year enrollment for all law schools of 2,806. The table indicates 2,006 students were graduated three years later, in 1971, a graduation productivity ratio of 71.5 percent. In 1969, the first year class was 3,526 and, by using the same 71.5 percent graduation ratio, we have projected a law school graduation population of 2,521 for 1972. The same extrapolation procedure was used for deriving the number of law graduates in 1973 and 1974. For 1975, the same number was used as in 1974 (3,470 since we assume that the 1972 first year total law school enrollment in approved California schools will be approximately the same as in 1971 (4,853), thus resulting in the same graduation number of 3,470 three years later. This gives us a grand total of 18,937.

Legal Manpower Demand

During the years 1968-1980, according to the U. S. Department of Labor, on the national scene there will be manpower needs for 65,000 new lawyers resulting from increased requirements for legal services, and 108,000 to replace those who die, retire, or otherwise leave the profession. Total legal manpower needs are therefore estimated to total 173,000, an average of 14,500 annually from 1968 to 1980.[16]

It should be noted that this annual average of 14,500 openings is significantly below the estimated new supply of lawyers during this time period since Table 10 indicated that if the present annual rate of growth continues in the nation's law schools, we should be graduating almost 30,000 students each year by 1974.

Turning to the official source of demand data for lawyers in California, the Department of Human Resources Development's publication, *California Manpower Needs to 1975*, estimates a total need of 7,100 new lawyers in California during the 1968-1975 time period; 3,300 resulting from new legal service requirements, and 3,800 as replacements due to deaths and retirements.

If we compare the projected California law graduate data shown in Table 14 with these figures, the results are an estimated surplus of 11,837 lawyers in California by 1975 if present trends continue. The table shows a total new supply of 18,937 law graduates during 1968-1975, as compared with the Human Resources Development total of 7,100.

It should also be noted that the Table 14 projection uses a 71.5 percent graduation ratio, which quite possibly represents a higher attrition rate than actually will be the case. If the attrition rate turns out to be less than estimated, the total number of graduates will therefore be larger than shown in Table 14, and the surplus of lawyers in California accordingly larger than estimated. In addition, if new law schools are opened during this time period, such as proposed for the Santa Barbara campus of the University of California, and the one now being discussed as part of the overall future expansion plans of the Claremont Colleges, the surplus could be even larger.

TABLE 14

PROJECTION OF GRADUATES FROM AMERICAN BAR ASSOCIATION APPROVED OR STATE ACCREDITED LAW SCHOOLS IN CALIFORNIA

1968-1975

First Year Enrollment	Number of Students	Graduation Year	Number of Graduates
1965	Unknown	1968	1,378
1966	Unknown	1969	1,443
1967	Unknown	1970	1,454
1968	2,806	1971	2,006
1969	3,526	1972	2,521 (estimate)
1970	4,469	1973	3,195 (estimate)
1971	4,853	1974	3,470 (estimate)
1972	4,853 (estimate)	1975	3,470 (estimate)
		TOTAL	18,937

Source: Graduate data from University of California, Office of Analytical Studies and the Association of Independent California Colleges and Universities. First year enrollment from the Committee of Bar Examiners of the State Bar of California; estimates are our own.

It should be further noted that the *California Manpower Needs to 1975* publication is considered unreliable in terms of manpower forecasts in California. As noted in our study of engineering, the assumptions that report uses are incorrect and therefore the job demand data are unrealistic and not considered valid for our purposes. Since their assumptions are based on continued economic growth, the number of new lawyers needed from 1968-1975 is probably optimistic, making the estimated surplus of lawyers still larger. However, we consider the publication somewhat useful only as a base of departure for comparing legal manpower supply with demand in California rather than for actual predictive purposes.

Job Demand and Social Need

The problem of predicting the future need for lawyers in California is indeed a difficult task. Quantitative comparisons of supply and demand are based on formulas and statistical data; much of this kind of information is questionable, if not invalid, since it is generated during a particular economic period and does not reflect long term societal needs. The problem in legal manpower planning is probably not the growing number of young people who want to be lawyers, but the need to develop ways to make it possible for everyone who needs a lawyer to have one. This is a social need.

Betty Vetter, Executive Director of the Scientific Manpower Commission, stated the distinction between social need and job demand well when she commented:[17]

> It is vital that we differentiate between "need" and "demand." We need all the trained specialists we can get just to clean up the environment, produce abundant power, reconstitute our molding cities, raise our health standards, conquer diseases, provide adequate transportation systems, and a host of other desirable things. But until the decision is made at all levels to budget one or more of these activities at the level needed to solve the problem, we have not translated our "need" for specialists into "demand" which means jobs.

As a result of our supply and demand analysis of current and projected legal manpower in California, is there cause for alarm? Current demographic projections suggest that the national population will increase by no more than 10 percent in the next decade, a percentage increase far below the projected increase in lawyers. Yet, as Dean Schwartz of the UCLA Law School suggests, "The needs for legal services of the poor, both criminal and civil, indicate that, with appropriate Federal funding, a significant number of new lawyers can be employed."[18]

According to a national news magazine, the Federal Office of Economic Opportunity (OEO) has increased the emphasis in this area and gone beyond the services offered by bar associations. The OEO

now has 1,800 government paid lawyers in 850 neighborhood offices in 285 communities and serves about a million clients annually.[19]

On this situation an authority comments:[20]

> Although the number of law graduates seems to be increasing, the supply of lawyers expected to be available in the immediate future may well be inadequate to handle even a slight increase in the middle-class public's use of lawyers' services, just as it seems already to be inadequate to supply the demand being uncovered by the legal services programs for the poor. Measures taken to make lawyers' services more readily available to people of moderate means may, therefore, result in demand beyond the capacity of the present legal profession to supply.

But another factor has to be added to the above speculations. The same forces that have led to the development of new patterns of legal delivery services, i.e., to the poor, including their cost, are leaning toward a different solution to the problem of legal services for those who need them; the elimination or substantial reduction of the need for lawyers in particular areas. Dean Schwartz indicates that surveys of the legal profession have pointed out that personal injury, domestic relations, and probate are in the top group of the types of legal problems that involve the time and produce the income of the privately practicing bar. Personal injury litigation is reported to account for 15-20 percent of the revenue of the bar. Yet, these are the very areas in which there is the greatest pressure to reduce the transactional costs; in the main, attorney's fees. "No-fault" insurance for automobile accidents has established a solid foothold, and, despite the opposition of the bar, will probably come to pass in California, and throughout the United States.[21]

California has already adopted a "no-fault" divorce system, a procedure between the two parties which does not require the services of a lawyer and that is being increasingly utilized. Simplification of the probate system is high on legislative agendas and, even if this does not come to pass, probate is the most common area for which paraprofessionals are being trained. Dean Schwartz therefore concludes that there is, indeed, a problem in the legal manpower area.

When viewed from the long term perspective, however, there are a few other alternative possibilities for absorbing the supply and demand imbalances that seem to be on the horizon. First, to the extent that the social need for legal services is perceived as a matter of national policy that must be satisfied, and therefore requiring high priority in funding, we shall probably see increased Federal employment and subsidy of lawyers beyond the present 1,800 lawyers in OEO programs alluded to before. That number could be multiplied many times. In fact, some advocates for the poor maintain that it would take the full time of the entire membership of the American Bar Association to handle adequately the legal problems of the poor.

Second, as former President Wright, of the American Bar Association, recently suggested, "more and more graduating law students will find their way into 'other pursuits.' Conceivably, legal education in the United States then will begin to resemble more closely that in many foreign countries; a general education, many of whose graduates do not intend to practice law, but who use that education as an entry into civil service, government, business, or other types of occupations."

An authority on professional manpower summarizes the problem of demand in these words:[22]

> The pervasive involvement of lawyers in so many aspects of the public and private sector makes it very difficult to determine precisely the future demand, but current trends in corporate size, government regulation of business, emphasis on adequate representation for the poor, and an overall rise in the importance of law in regulating society's affairs indicate that the demand will increase to absorb the supply--indeed, that the supply will, in a sense, create its own demand.

Conclusions

On the basis of our analysis of national and California legal manpower supply data for the 1970-1980 decade, the evidence appears conclusive that students are showing an unprecedented interest in legal education. On the national scene, a remarkable growth in law school enrollment was noted, more than doubling from 1960-1971. If present trends continue, the American Bar Association's estimate that the law profession will approximately double by 1985 seems reasonable.

In California, the data reveal the same spectacular growth trend in students' interest in legal education. This has been especially true during the last three years, when the State's seventeen ABA approved or accredited law schools' total enrollment increased by 5,413 students, or 84.1 percent, while total first year enrollment rose 2,047 or 73 percent.

It also appears, from this analysis, that the State's present seventeen private and public law schools, either approved by the American Bar Association or accredited by the California Committee of Bar Examiners, are presently operating at or near peak capacity but are unable to satisfy ever-increasing student applications for legal education in California. Many thousands of apparently highly qualified California students, who apply for admission to law schools in the State each year, both public and private, are turned away because of space limitations in existing legal facilities.

Based on our comparison between the current and projected supply of new law school graduates in California, with the California

Department of Human Resources Development's job demand projections for 1968-1975, there appears to be a current surplus or overproduction of lawyers in the State. We estimate the surplus to be approximately 11,837 by 1975, if current law school graduate trends continue at the present rate. Quite possibly, if the annual projected rate of 3,470 law school graduates continues, the surplus in California by 1980 could be even greater, unless new demands for legal services appear during that time period. However, we can only speculate about supply and demand relationships during 1975-1980 since job demand data for lawyers in California were unavailable from the Department of Human Resources Development for that period.

When viewed from the perspective of "social need" rather than job demand for lawyers in California, as well as the nation, we conclude that there probably is not, at present, and probably will not be a future surplus of lawyers during 1970-1980 to provide legal services to all those citizens who require them.

Because of the impact of anticipated significant social change in California and the nation during the 1970's, we foresee the development of increased requirements and demands for legal services during this decade. These requirements are related to the administration of justice, elements of due process mandated by the U. S. Supreme Court, improvement of the environment legal services to the poor, and consumer litigation. However, whether these social needs will be met or not, will, in our judgment, depend in large measure on whether the Federal government or the State of California perceive them as a matter of national or State policy requiring high priority and the necessary funds to support them.

Finally, whether the State of California should or should not respond to the well-documented and ever-increasing number of applicants for legal education in California by creating new law facilities raises broad issues of policy that are, of course, beyond the scope of this study. We are aware of previous recommendations by several special committees to establish additional law schools on University of California campuses and that the Santa Barbara campus has been chosen as the next University law school location. Indeed, "the preliminary 1969-1970 budget called for planning money for the Santa Barbara campus, but because of fiscal stringencies this item was deleted from the budget actually submitted to Sacramento."[23] Further, the 1972-1973 Operating Budget request of the University includes provision for the salary of a Dean, initial support costs, and the establishment of a law library.[24]

In view of our supply and demand analysis of legal manpower in California, the implementation of a new State-supported law campus appears to be more than justified in terms of ever-increasing students' interest in legal education, and when viewed from the standpoint of anticipated "social need." On the other hand, if we have any degree of confidence in the current and projected job demand data for lawyers in California or on the national scene, we are forced to conclude that

the creation of a new law facility in California at the present time would probably be unwise. In law, then, as in several other professions we have examined in this study, we are faced with a serious policy issue of whether supply should be determined on the basis of the economic variable, i.e., the anticipated job demand, or social need and California students' interest in pursuing law careers.

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D. TEACHING

Introduction

In teaching, the largest profession, the 1970-71 school year marked the transition from almost three decades of national shortages of elementary and secondary public school teachers to an era in which the nation's supply is expected to exceed the demand each year until at least 1980. Indeed, according to Clark Kerr, Chairman of the Carnegie Commission on Higher Education, if present trends continue, in the 1970's the nation could have a surplus of one to two million teachers.[1]

Studies by the National Education Association (NEA) Research Division indicate that the total supply of qualified teacher education graduates available for entry into teaching positions during the fall 1970 school year exceeded the number of positions open to them by at least 50,000 persons.[2] In the fall 1971 school year, enrollment growth required the addition of approximately 19,000 teaching positions in public elementary and secondary schools. That increase is the lowest in at least twenty years. The 19,000 figure is "less than one-half of the number of new positions created during each year between 1954 and 1969, while the size of the graduating class prepared to enter teaching doubled between 1954 and 1964 and has been more than three times the 1954 levels since 1969."[3]

A surplus of qualified teaching applicants for a sharply reduced number of openings in elementary and secondary schools was reported in all sections of the country in 1971. According to surveys by the National Education Association (NEA) in midsummer 1971, many schools drew upon the teacher surplus condition to improve the quality of staff and instructional programs. In 21 states, the percentage of new teachers with qualifications higher than the nimimum standards for certification was increased as compared with 1970.[4] Unfortunately however, in the majority of large school systems, financial limitations slowed, arrested, or even reversed trends toward improved school programs and staffing.

The NEA reported that over 90 percent of the pupils in 37 large school systems were in schools adversely affected by inadequate financing.[5] The same NEA study found that not a single one of the 48 states reporting had an overall shortage of teacher applicants, in contrast with the situation five years ago when 31 states reported general shortages of teacher candidates. Half the states surveyed reported only excesses of teacher candidates; the other half reported surpluses of applicants along with some small shortages in specialized fields such as industrial arts, special education, trades, mathematics, vocational subjects, speech correction, and distributive education.

Teacher Supply and Demand Problems

This rapid turnaround in employment conditions in the nation's elementary and secondary schools during the past few years, from a general scarcity to a widespread surplus, has not only surprised and amazed the majority of teacher applicants, administrators, and the

public at large, since the surplus condition has been well-publicized, but it has progressed to the point of national and state concern. This is not surprising since in school teaching, the profession in which new graduates of the 1970-71 graduating classes have been having the greatest difficulty in finding jobs, one out of four college graduates teaches school. Among women, roughly 50 percent of all professional employment is accounted for by teaching. Among men, 15 percent of all professionals are teachers and the elementary and secondary sector comprises more than one-third of all professional employment in the nation.[6]

This sudden and unexpected turn of events not only affects the nation's teachers, but reportedly turned away hundreds of qualified California teachers during the 1971-1972 school year because of unavailable openings. It also jeopardized the future of thousands of prospective teachers who are in various stages of completion of the required five years of teacher preparation in California's colleges and universities.

In a study published in 1965, the California Department of Education estimated the available supply of teachers to be approximately 65,150 fewer than needed to meet the demand from 1965-1975, an average annual deficit of 6,510 teachers.[7] Another teacher supply and demand study, covering the same 1965-1975 time period, and performed by a private consultant firm, reached essentially the same conclusions. Its report stated that "by any reasonable set of assumptions about attrition, and assuming that present teacher preparation institution trends continue, there will be large annual shortages of thousands of new elementary teachers in California in each of the next ten years."[8] (Emphasis in the original). That study was published by the consultant firm in February, 1967.

In an updated study completed in August, 1968, the California Department of Education still was estimating that California would need an additional 5,680 teachers per year from 1968 through 1971 to meet increased enrollments, and an additional 14,600 teachers to replace those who retire, die, resign or who need to be replaced because of dismissals or leaves of absence. This represents a total of 20,280 teachers per year during that time period.[9]

A number and variety of reasons have been cited as contributing to the market change for teachers. First, as we have already noted in our analysis of engineering supply and demand, the Federal government has come to dominate both the demand for the products and services of some industries, i.e., aerospace and defense, and investment in those industries. In the aerospace and defense industry in California, it was scientists of all types and a variety of engineers who were adversely affected. Changes in the rate of Government expenditures resulted in serious alterations in the demand for manpower, specifically scientific and professional workers.

In the teaching profession, the Federal government impact has contributed significantly to the present imbalance in the supply and

demand equation. In the early 1960's the infusion of Federal money under the National Defense Education Act and the Elementary and Secondary Education Act was responsible for the additional employment of 140,000 school teachers throughout the decade.[10] Beginning in 1966, the massive increase in Federal support for improvement in the quality of education contributed to the demand for teachers, and therefore served to postpone the beginning of a teacher shortage for about three years. The recent cutbacks in the number of jobs for college graduates in engineering, chemistry, and other science-related occupations, have enlarged the supply of potential teachers; both from persons who have previously been employed in those fields and from teacher education graduates who normally enter fields other than teaching. For example, in the 1960's, when the demand for college graduates was fairly strong, only seven of ten qualified teachers applied for classroom jobs. Others either did not enter the labor force or found employment elsewhere.

Second, a steadily increasing percentage of all bachelor degree recipients who are eligible to teach has risen from about 30 percent in 1955 to approximately 40 percent in 1970. Combining this with the large expansion in the total number of college graduates results in an enormous and continuing projection of growth in the total number of eligible teachers being produced each year.

According to William Graybeal, Assistant Director of the National Education Association's Research Division, "the anticipation of an era of teacher surpluses is an expected outcome of the pattern in the numbers of children born each year during the past 25 years, beginning with the rise in births after World War II. The sharp increase in the new supply of beginning teachers starting around 1969 reflects the 34 percent increase in the number of children born in the 1946-47 fiscal year; the number rose from 2.9 million to 3.9 million." Graybeal also indicates that the numbers reaching the age of normal college graduation will increase steadily until about 1982 and then will begin an annual decline for several years afterwards.[11]

Finally, and by far the most significant reason for the turn-around in the market for teachers, nationally, but particularly in California, has its roots in demographic factors. A decline in the school-age population, with a consequent drop in the demand for new teachers, has interacted with an unprecedented rise in the college-age population, and hence in the numbers of new graduates seeking jobs. This is quite a different situation from engineering manpower problems, as we have seen earlier in this report, where unemployment of experienced workers are the main source of concern and current job-finding difficulties are chiefly traceable to the economic recession in California, as in the nation.

On the national scene, the era in which the numbers of school-age children were increasing each year is now being replaced by a period in which the numbers are decreasing each year (the impact of the smaller numbers born annually since 1960-61 is being felt now in the primary grades and the rate of enrollment growth in secondary

school grades has slowed because the children born during the years of highest birth rates are now in secondary school).

School Enrollment in California

Due to unanticipated sharp school-age enrollment declines, the job market for teachers in California is indeed softening. In June, 1971, many college graduates were disappointed in their quest for teaching positions in elementary and secondary schools. Teaching openings had suddenly become extremely difficult to find. Not only recent graduates, but also older women, who all through the 1960's had no trouble returning to teaching after their children had grown up, were faced with unencouraging employment prospects. Many well-qualified and credentialed teachers, mostly men, who had left teaching to work in industry and been laid off there because of the declining economy, tried to return and found there were few, if any, openings. Many of these unemployed teachers withdrew to Australia where shortages existed, a widely reported news item in the local and national press.

The basic cause of the teacher market turnaround in California, is demographic; school enrollments have declined in widespread areas of California, ending more then a decade of soaring growth. In 1968, as mentioned earlier, the State Department of Education forecast a continuing need for 20,280 teachers annually through 1971, based on school population forecasts showing overall elementary enrollment stabilizing in 1971 and 1972.[12] This trend in the demand for teachers has obviously not occurred according to their estimates. As noted in a subsequent section, the overall elementary school-age enrollment in California schools stabilized sooner than expected, in 1969, and has steadily declined each year. The forecast to 1980 is even more dismal in terms of teacher demand.

The results of falling statewide enrollments, the first time that has happened in California, according to Department of Education records, have been dramatic. In several school districts, there is excess capacity in classroom space, causing actual or recommended closing of entire schools in communities like East Whitter, Pasadena, West Covina, and Downey, where the enrollment decline has hit hardest.[13]

In East Whittier, more than one-third of the school system's classrooms could be vacant within three years. Los Angeles city schools, surprised by a net loss of nearly 12,000 this year, are now estimating a further drop of almost 45,000 over the next five years. This year in Los Angeles, the result has been that 186 teachers, who began the year as regular classroom instructors, were reduced to substitute assignments because of enrollment losses.

Pasadena Unified School District, where enrollment has declined 14 percent in five years, is studying a proposal to close two schools and sell them. One school has an enrollment of only 141 pupils and two others with fewer than 300. West Covina Unified School District is closing one school and will convert it to an adult education center.

The District, according to the Los Angeles Times, is faced with the prospect of a 25 percent drop in enrollment by 1978, and one administrator believes it may have to close an elementary school every other year for the next six years, and possibly an intermediate school as well.

Downey Unified School District is closing four elementary schools and one junior high in stages, starting this year and ending in 1974. The Downey system, which enrolled 22,000 only ten years ago, is now down to 17,200 and expects a further drop to 15,000 by 1975 before stabilizing. Other school districts in the State report similar plans for closing.

What caused this sudden downward spiral in California school enrollments? A lower birth rate, due, some say, to the slumping economy, wider use of birth control measures, new concern about environment and over-population, and ever-increasing use of "demand" abortions. A lower net migration also has added to the decline; whether this is due to people leaving California or by fewer coming to California, or a combination of both, is unknown. In former years net migration each year was estimated to be 299,000. Lately, this figure has dropped to an estimated 25,000 last year, according to the Department of Finance.

Whatever the reasons, the best statewide estimates had been that school enrollments would climb to 4,461,000 this year, compared with 4,457,325 last year. Instead, California schools enrolled 4,424,264, some 33,061 fewer than the prior year and lowest statewide enrollment since 1968, a figure that is also lower than what had been previously predicted by the State Department of Finance for any year through 1980.

The effect of these enrollment declines on teacher demand and staffing patterns has been drastic. Districts that once hired hundreds of new teachers each year now require only a fraction of that number, and often only in specialty areas. Once, teachers could count on being hired months before school began. But now, districts that are not sure about enrollment, are waiting in some cases until school actually begins before hiring teachers. Some declining districts have not been able to rehire already employed teachers. Permanent teachers with tenure and seniority are usually secure, but first-year and even some second-year teachers have lost jobs because of the enrollment slump. Others have received notice of termination, then been hired back at the last minute due to unexpected faculty turnover.

Teacher Demand in California

The unanticipated and sharply declining school-age enrollment in California schools and its resulting impact on school closings and the demand for new teachers has resulted in considerable uncertainty among local school district personnel and State education officials as to the future job market for elementary and secondary school

teachers. Projections of current and future demand for elementary and secondary teachers in the State are therefore extremely difficult, if not impossible, to make with any validity at this time. We simply do not have the necessary local school district information throughout the State to make reliable estimations.

For example, in 1969, before any of the falling enrollments in California schools were known, the California Department of Human Resources published its well-known publication, *California Manpower Needs to 1975*, wherein it was estimated that the job outlook for teachers was quite favorable in the years from 1968-1975.[14] New openings for elementary teachers caused by expansion (rising enrollments) were estimated to be 12,300; replacement needs (deaths and retirements) were shown as 22,400, resulting in total job opportunities of 34,700.

In the secondary school sector, 25,800 new openings were forecast, with 11,800 positions to replace teachers due to deaths and retirements, for a total of 37,600 secondary school job opportunities for teachers. These figures reflect a pre-1969 school enrollment situation based on overly optimistic assumptions that are not consistent with the trends outlined in the previous section. Falling school-age enrollments do not seem to have been considered in making the demand projections for teachers.

In order to perform a teacher demand analysis in California properly, we would need to determine: (1) the current number of full-time certificated teacher employees in the State's schools, both elementary and secondary, as reported by county and district superintendents of schools throughout the State, (2) estimates, based on previous experience, of the number of new teachers who will be needed to replace those whose death, retirement, or resignation will create vacancies in those schools, and (3) estimates of those who will be needed to meet the demands of current and anticipated California enrollments, based on some arbitrary or perhaps historical pupil-teacher ratios since these determine the actual number of teachers needed.

With the exception of projected graded student enrollment through 1981, prepared in February, 1972 by the Population Research Division of the Department of Finance, the required statistical data are unavailable. Missing data include the number of current full-time certificated employees in the State, both elementary and secondary teachers; the number of new teachers needed for replacements; and the estimated number of teachers needed (at current or past per-pupil ratios) to meet the Department of Finance's current and projected school-age enrollments from 1970-1980.

It is understood that the State Department of Education plans to undertake a study of the current and projected teacher supply and demand situation in California, but unfortunately, the results of such a study were unavailable for our purposes. Education planning for elementary and secondary school teachers may well be the most pressing

problem for California educational planners in the 1970's. This is because of the very large number of individuals involved, the serious nature of current and forecast teacher surpluses during the next decade, and widely reported unemployment conditions among teachers in California.

Table 15 shows the projected school enrollment picture for California public schools from 1965-1981. As noted earlier, the fall 1971 total enrollment indicates a drop of 33,061 from last year and the lowest enrollment figure since 1968. The most significant figures, however, from the teacher demand standpoint, are those showing the continued total statewide enrollment decline through 1979, with a slight upturn beginning in 1980 and continuing in 1981. Elementary school enrollment shows steady yearly decreases and a total drop of 302,839 students during the years from 1970 to 1978 (3,168,439 to 2,865,600), when enrollments again begin to rise slightly.

On the other hand, secondary school enrollments increase steadily from 1970 to 1976 (1,288,886 to 1,379,000), not surprising, since these students were moving through the secondary school before the economic slump and the effect of declining birth rates, now being reflected in falling elementary school enrollments. However, Table 15 also shows that the decline in student enrollment in the elementary school will begin to be felt at the secondary school level, starting in 1977, when enrollments show a slight downward trend and a sharp dip in 1980, and continuing in 1981.

Since we do not have the necessary data on the numbers of certificated elementary and secondary teachers in the State, student-teacher ratios in either the elementary or secondary schools, or the numbers of teachers who will need to be replaced next year and in subsequent years, we have very little information upon which to estimate the current and projected demand for teachers in California. What we must conclude, however, from an examination of the sharply declining enrollment data shown in Table 15 is that we can be reasonably certain there will be substantially less demand for teachers in California from 1970-1980 than was formerly the case. Those who will be needed will probably be used for replacement purposes only, rather than to fill new job requirements resulting from increases in enrollment.

Teacher Supply in California

Whether or not California exceeds or falls short of the estimated demand for new elementary and secondary teachers during the 1970-1980 decade will depend in large measure upon the number of teachers that California colleges and universities expect to graduate during that period of time, with the required credentials specified by the State Commission on Teacher Preparation and Licensing. Of course, other sources of supply which should be utilized include: (1) teachers who return to teaching after one or more year's absence from teaching, and (2) teachers recruited from out of State. For purpose of our study, however, since data on those teachers are also unavailable, we have confined our analysis only to the estimated new supply of

TABLE 15

REPORTED AND PROJECTED GRADED STUDENT ENROLLMENT
CALIFORNIA PUBLIC SCHOOLS

1965-1981

Fall	Total[a]	Kindergarten Thru Grade Eight	Grades Nine Thru Twelve
Reported:			
1965	4,121,442	3,010,929	1,110,513
1966	4,235,167	3,087,335	1,147,832
1967	4,330,375	3,145,569	1,184,806
1968	4,412,035	3,186,181	1,225,854
1969	4,440,924	3,178,358	1,262,566
1970	4,457,325	3,168,439	1,288,886
1971	4,424,264	3,107,862	1,316,402
Projected:			
1972	4,385,600	3,054,100	1,331,500
1973	4,351,300	3,004,200	1,347,100
1974	4,325,200	2,963,800	1,361,400
1975	4,302,500	2,930,600	1,371,900
1976	4,267,400	2,888,500	1,379,000
1977	4,240,200	2,866,500	1,373,700
1978	4,221,800	2,865,600	1,356,200
1979	4,213,300	2,898,600	1,314,700
1980	4,223,000	2,960,900	1,262,100
1981	4,254,900	3,034,800	1,220,100

Adapted from table provided by Population Research Division, California Department of Finance, February 2, 1972.

Note: [a]Sum of parts of projected figures may not equal totals because of independent rounding.

instructional personnel during the specified time period. This analysis will be described in a later section.

Additional Teacher Manpower Data

Brief mention should be made here of another State source of teacher supply and demand data that was examined during the present study, the State Department of Finance's analysis of teacher supply and demand covering the years 1970-1980, published in the fall of 1971.[15] The study was carefully reviewed as a possible data source for teacher supply and demand and as a basic frame of reference. Since it contained school-age enrollment projections to 1980, and both teacher demand and supply information, it appeared to be a very relevant reference for our purposes. However, upon closer examination, because of certain problems in using the statistical data it provides, and the use of some puzzling assumptions in forecasting teacher surpluses, we did not find it especially useful.

First, since projected school-age enrollment is one of the two principal variables in estimating teacher demand, the other being student-teacher ratio, we compared the Table 15 enrollment projection data with the enrollment figures used in the earlier Department of Finance study. There were indeed wide discrepancies, possibly due to the fact that the demographic data provided to us by the Population Research Division of the Department of Finance were later and therefore more current than the fall 1971 study. For example, although the total number of children enrolled in both elementary and secondary schools during fall 1967-1970 were the same in both cases, the number of elementary school children was different, as well as the number of secondary school students.[16]

For example, in 1968-69, the Finance study showed a total elementary school population of 2,813,440 and a total secondary school enrollment of 1,627,484, for a grand total of 4,440,924. The figures provided for this study show agreement in the total of 4,440,924 but sharply disagree in the elementary and secondary enrollment; elementary enrollment shows 3,178,358 (considerably more than the 2,813,440 reported in the Finance study), and 1,262,566 for secondary school enrollment, as compared with the higher 1,627,484 figure shown in the Finance study. Evidently, the earlier study used a different method for listing student enrollment in the two levels of education. The same discrepancy shown in the years 1967-1970 also continued throughout the forecasted years, 1970-1980.

Perhaps in the earlier Finance study elementary school children include only kindergarten through sixth grade students, and secondary school includes seventh through twelfth grade students. If this is true, then that might account for the larger number of elementary school children in our Table 15 for that year, and the samller number of secondary school students. For example, Table 15 lists elementary school children from kindergarten through the eighth grade and secondary school youth from grade nine through twelve. Therefore, because of the obvious difficulty in using the earlier Finance study's

school-age enrollment data for predicting teacher demand for elementary and secondary teachers, we were unable to use them.

Second, the earlier Department of Finance study concluded that elementary and secondary public school enrollment "would remain at a relatively constant level during the 1970-1980 time period."[17] Our Table 15 figures disagree significantly, showing a total net decline in elementary and secondary enrollment of 234,325 from 1970-1980. Although not shown here, the Department of Finance's projection only shows an overall net decline of 11,225 students during that time period.[18] Our February, 1972 data in Table 15 also show a steady yearly decline in total enrollment from 1970 to 1980, where a slight overall increase is noted (4,213,300 in 1979 to 4,223,000 in 1980). On the other hand, the Department of Finance's study showed an "up and down" pattern during this decade and only a net decline of 11,225 students.

Third, we were puzzled by the assumption in the earlier Department of Finance report concerning teacher excesses and accumulating surpluses each year from 1971-72 through 1979-80. The report states:[19]

> The excess indicates the number of new teachers who will not find employment, given perfect information about available jobs and their locale and the willingness of teachers to practice their profession wherever openings exist.

The column labeled "accumulating surplus" denotes the summation of the projected yearly excesses, or a total of 18,331 elementary teachers by 1979-80, going from 1,988 in 1971-1972; for secondary school teachers, the accumulating surplus total was 15,074, going from 478 in 1971-72.

The report goes on to conclude that the excesses each year between its projected supply and demand, and the resulting accumulating surpluses represent the teachers produced at public expense who will be unable to obtain employment. The State's reported investment in an oversurplus of teachers by 1980 is estimated at 67 million dollars, including a "sunk" cost of approximately 14 million in presently unemployed teachers.[20]

We simply disagree with the accumulating surplus concept used in the Finance study because the underlying assumption lacks credibility, namely that highly educated people (teachers) will continue, year after year, to pursue the long and costly training required in the face of anticipated unemployment when they complete their training. Short-term oversupply, or surplus of educated persons seems a reasonable possibility, since there clearly are time lags in the adjustment of supply and demand. But this lag is more like two or three years duration, and certainly would not apply to a ten year forecast. In other words, we believe that the supply of teachers will adjust significantly to the demand within the next several years, based on the fact that in forecasting prospective teacher behavior we are

dealing with intelligent, rational manpower who act with reference to past and present experience, not to mention future expectations. There is, and there probably will continue to be surpluses, but the idea of accumulating large numbers of teacher excesses from year to year, does not seem reasonable. It therefore follows, that if the accumulating surplus assumption is incorrect, then the State's estimated investment figures of 67 million dollars, including the "sunk costs" of 14 million dollars, are also incorrect.

Thus, for these and other less important reasons, we were very skeptical of the 1971 Department of Finance study of teacher supply and demand and therefore did not use the statistical data it contained, except as a point of departure.

Problems in Data Collection

In this study, not only were teacher demand data unavailable, but extreme difficulty was also encountered in obtaining current and projected data relating to teacher supply in California. This was due in part to the fact that the Association of Independent California Colleges and Universities (AICCU) does not have statewide data collection capabilities and resources and could not provide the necessary data from their member colleges and universities, which represent a sizeable number of teacher preparation institutions in the State. Data were also not available from non-member colleges and universities.

Further, neither the Office of Analytical Studies, University of California, nor the Office of Institutional Research, California State University and Colleges, keeps annual records of the number of students completing their preparation for teaching in the elementary or secondary schools with either a bachelor's or higher degree.

Each of the individual teacher preparation institutions keeps these records, but annually forwards the statistics directly to the Commission on Teacher Preparation and Licensing rather than through the central administrative offices of the University or the State University and College systems. The Commission, in turn, forwards these data, including those from the teacher preparation institutions representing the independent colleges and universities and the non-AICCU colleges in the State, to the National Education Association, in Washington, D.C., for later publication in its annual national report of teacher supply and demand. This report is issued each year and includes data for the previous year. For example, the 1971 NEA report is not yet published; it will be forthcoming sometime after the close of the 1972 academic year.

Apparently, the principal reason for this data collection problem is that certain provisions of the 1961 Certificated Personnel Law, more commonly referred to as the Fisher Act, made it difficult for the central administrative offices of the University and State Universities and Colleges to keep track of students who are preparing to teach, either at the elementary or secondary school levels. The

Act was passed by the California State Legislature to take effect on January 1, 1964. It changed considerably the requirements for credentialling for those majoring in education. Majors were limited to academic subjects, i.e., natural sciences, social sciences, humanities, mathematics, and fine arts, but did not include subjects which seemed primarily oriented toward application, such as agriculture, home economics, and education. The Act intended to insure that elementary teachers would be "liberally" educated, adding the liberal education requirements to those in foundations of education, education methods, and student teaching, and resulted in a five-year course requirement necessary for the receipt of credentials.

Interpretative regulation changes were later passed by the State Board of Education. The most significant was that the fifth year of college could be postponed and completed over a period of five years after the beginning of teaching for secondary school teachers and seven for elementary teachers. Teachers who completed four years of college and some of the specific credentialling requirements were granted a regular standard teaching credential. If an employing school district certified to the need for a teacher, he or she might be granted a provisional credential on the basis of 90 semester hours (for elementary teachers) or a bachelor's degree (for secondary school and junior college teachers).[21]

As a result of these changes, the central offices of the University and the California State University and Colleges no longer provide annual data about students who are preparing to enter the teaching profession. Data are available concerning students majoring in the various academic disciplines and fields of study but these figures cannot easily be disaggregated to identify students who are preparing to teach in the elementary or secondary schools.

In view of this data collection problem, surprising as it is because of the large number of teachers involved and the serious nature of reported teacher unemployment in the State, we were forced to use national teacher supply and demand reports published in prior years by the National Education Association and containing California demand data in public schools, 1967 through 1970. As stated earlier, 1971 data are still not available, pending the NEA's 1971 annual research report. It should be noted that the NEA data provide aggregate teacher supply numbers for the State of California as a whole, rather than by individual segments of higher education in the State.

Total Supply from California Institutions

During the 1967-1970 time period covered in this analysis, there were fifty-two colleges and universities in California accredited for teacher education by the State Board of Education, and, in recent years, by the new Commission on Teacher Preparation and Licensing Commission. These institutions included nineteen state colleges, eight from the University of California and twenty-five independent colleges and universities. Table 16 shows the actual and estimated

total production of elementary teachers in the State during fall 1966 through fall 1970, as well as by degree level, both baccalaureate and Master's degree (or fifth year of preparation, the State requirement).

An examination of the total production of elementary teachers in Table 16 shows, with the exception of a large dip in the fall of 1967 (possibly due to reported widespread confusion over the new State credential requirements), a steady upward growth from that year through the fall of 1970 (estimated), an overall change of just slightly under a 50 percent increase in the supply of new elementary school instructional personnel.

TABLE 16

ACTUAL AND ESTIMATED CALIFORNIA COLLEGE AND UNIVERSITY STUDENTS RECEIVING DEGREES AND PREPARATION TO TEACH IN THE ELEMENTARY SCHOOLS

1966-1970

Year	Bachelor's Degree	Master's Degree	Total
1966 (Fall)	3,774	1,108	4,882
1967	2,142	1,742	3,884
1968	1,924	2,684	4,608
1969	2,947	3,735	6,682
1970 (estimate)	2,765 (estimate)	4,544 (estimate)	7,309 (estimate)
Total	13,552	13,813	27,365

Four year change:	Numerical	Percent
1966-1971	2,427	49.7

Source: National Education Association, Research Division, Teacher Supply and Demand in Public Schools, 1967; 1968; 1969; and 1970.

Table 17 shows an opposite trend, an overall decrease of 11.6 percent for secondary teachers. However, this figure is misleading since it includes the same large drop in total degree production for the fall of 1967 of 2,677 students from the previous year (7,270 to 4,593). Beginning in the fall of 1967 through the fall of 1970 (estimated) however, amounts to a numerical increase of 1,832 students, or a rise of 39.8 percent. This steady upward trend during the past

four years is more significant for our projection purposes than the one year decrease in 1967.

TABLE 17

ACTUAL AND ESTIMATED CALIFORNIA COLLEGE AND UNIVERSITY STUDENTS RECEIVING DEGREES AND PREPARATION TO TEACH IN THE SECONDARY SCHOOLS

1966-1970

Year	Bachelor's Degree	Master's Degree	Total
1966 (Fall)	2,069	5,201	7,270
1967	910	3,683	4,593
1968	624	4,848	5,472
1969	687	5,227	5,914
1970 (estimate)	923 (estimate)	5,502 (estimate)	6,425 (estimate)
Total	5,213	24,461	29,674
		Four year change:	Numerical Percent
		1966-1971	-845 -11.6

Source: National Education Association, Research Division, Teacher Supply and Demand in Public Schools, 1967; 1968; 1969; and 1970.

Supply and Demand Comparisons

Extrapolating from Table 16 (elementary teachers) for only the years 1967, 1968, and 1969 (for ease in comparing these figures with the California Department of Human Resources Development's estimates for 1968-1975) gives us an actual total of 15,174 for those years (3,884, 4,608 and 6,682, respectively). Using the Table 16 estimated NEA figure of 7,309 for 1970, it seems reasonable to use the same figure for 1971, since we were unable to obtain the actual data for that year. However, beginning with graduates in 1972, and continuing on, we can expect some significant decline if teacher preparation institutions and students are at all responsive to the declining labor market for teachers, beginning in 1969, when the California economic recession actually began and students commenced their teacher preparation programs. We believe a total decline of 10 percent in degrees completed is reasonable but possibly conservative, although we have no evidence to support that figure, even though overall college

and university enrollment in California are reportedly showing an 8 percent decline this year, as reported in the engineering analysis.

Using a reduced figure of 6,578, or ten percent less than the 7,309 estimated for 1971, for each year from 1972 through 1975 would result in a yearly output in total degrees from 1968 to 1975, as follows:

Year	Total Degrees
1967-1968	3,864
1968-1969	4,603
1969-1970	6,682
1970-1971	7,309 (estimate)
1971-1972	7,309 (estimate)
1972-1973	6,578 (estimate)
1973-1974	6,578 (estimate
1974-1975	6,578 (estimate)
Total	49,526

The California Department of Human Resources Development (HRD) forecast a need for 12,300 new elementary teachers on the basis of expansion, and 22,400 to replace teachers leaving for retirements, deaths, and other reasons; an overall total of 34,700 elementary teachers during 1968-1975.[22] The difference between these two figures, 49,526 in our estimates, and 34,700 by the Department of Human Resources Development, results in an estimated surplus of 14,826 elementary school teachers, if present trends continue. However, since the HRD estimates are considered larger than can be anticipated because their assumptions were based on a "rosy glow" future economic picture and continued school-age enrollment increases, their projections of teacher demand are probably higher than can be expected, which would therefore result in a much higher teacher surplus. On the other hand, if the student decline in degrees is more than the 10 percent we have estimated from 1972-1975, the surplus could be somewhat less than anticipated.

Looking at the secondary school picture shown in Table 17, and using the same extrapolation procedures, i.e., actual figures for 1967-1969, the NEA estimate for 1970, the same figure for 1971, and a 10 percent decline for the 1972-1975 years, results in the following:

Year	Total Degrees
1967-1968	4,593
1968-1969	5,472
1969-1970	5,914
1970-1971	6,425 (estimate)
1971-1972	6,425 (estimate)
1972-1973	5,782 (estimate)
1973-1974	5,782 (estimate)
1974-1975	5,782 (estimate)
Total	46,175

The HRD forecast a need for 25,800 new secondary teachers during 1968-1975, and 11,800 for replacement purposes, or an overall new supply of 37,600. The difference between the HRD estimates and ours (46,175), if trends continue, is an 8,575 surplus. However, if institutional and student responsiveness to the labor market result in sharper declines during the next several years in the supply of secondary school teachers, and if the HRD demand estimates are, in fact, too large, the net effect will probably be less of a surplus, but still a significant imbalance between teacher supply and demand.

Conclusions

Because of the unavailability of current and reliable teacher supply and demand data from California sources, we were forced to extrapolate from various State and national sources. The results are crude estimates. Despite these shortcomings, however, all the available evidence appears to be conclusive that there is now a surplus of elementary and secondary teachers in California, and, unless both supply and demand trends change sharply during the next few years, there will continue to be an oversupply of teachers in California, at least during this decade.

According to the *Manpower Report of the President*, the present scarcity of teaching jobs at the national level is also expected to become more pronounced as the decade progresses. In sharp contrast with the increase of more than 700,000 in employment of elementary and secondary teachers between 1960 and 1970, the number employed is expected to rise by perhaps 40,000 during the 1970's.[23] This leveling off in requirements will coincide with the projected continuing rise in college graduations, pointing to a serious oversupply of teachers unless the proportion of college graduates seeking teaching careers declines sharply.

Because of rapidly declining enrollment of school-age children in California during the 1970's, the main source of demand for new teachers in the 1970's will be replacement requirements for teachers who retire, die, resign, or otherwise leave the profession.

The teacher surplus will constitute a major problem for women seeking professional careers in California, as well as on the national scene. As noted earlier, teaching is by far the largest field of professional employment for women, accounting for approximately two-fifths of all those in professional and technical jobs. Many young women are already responding to the declining market situation in teaching by shifting to other fields. In the fall of 1971, for example, freshman enrollment in schools of education declined an estimated 14 percent from the 1970 figure while enrollment in nursing rose substantially.[24]

Many educators, teacher groups, and the professional associations view the current and projected surplus of teachers as an opportunity to improve the qualitative aspects of school instructional programs. If either the Federal or state governments or local school districts should decide to take advantage of the current and projected over-supply of teachers by providing increased financial support for lower student-teacher classroom ratios, more selective entry level standards, fewer teachers with inadequate or minimal qualifications, early retirements and resignations for weak teachers, the addition of special education teachers, and early childhood and vocational education programs, it is likely that the anticipated surplus would be significantly reduced or at least postponed.

These staffing improvements and new programs could create an immediate and sizeable increase in the demand for new teachers, and could probably result in qualitative differences in school programs. However, widespread and strong taxpayer resistance to higher property taxes in California, recent and continuing defeats in local school bond issues and tax override elections, and recurring school revenue crises in California state finance are not encouraging since these new programs would result in sizeable increases in school costs.

On the other hand, the State Department of Education, under the leadership of its Superintendent of Public Instruction, Wilson Riles, has recently proposed the restructuring of its early childhood education program, which, if implemented statewide, could require huge increases in the demand for new teachers. The program and legislation provide for a new learning environment and experience for children from age four through eight. According to the Southern California Committee for Early Childhood Education, "the program would be accomplished in a restructured non-graded primary school with strong parental involvement and on-going in-service education for teaching personnel, administrators, and parents. The goal is to lay the foundation for a quality, individualized education during the crucial early years in order to prevent the need for costly and often ineffective remedial work later on."[25]

State Assembly and Senate bills proposing this program are now being reviewed by the appropriate Education Committees of the California State Legislature. If this program should be approved and funded, there seems to be little doubt that additional teachers would be required, thus relieving the surplus, although the principal purpose and major thrust of the program is to improve the quality of early childhood education programs, rather than reduce teacher surpluses. While we cannot estimate the numbers of new teachers such a program would require, we would be surprised if this new program grew rapidly enough to absorb a significant portion of the anticipated surplus of elementary teachers in California during this decade.

We further conclude that cutbacks in the supply of new teachers is a possibly beneficial response to the current and forthcoming surplus. In fact, policies regarding institutional limitations on enrollment in teacher education programs in California colleges and universities, similar to those now in effect in other states, may already be in operation, although we are unaware of such policies. For example, Michigan State University, which says that it has long produced more teachers than any other institution in the country, recently announced a program of "enrollment control" at its College of Education to limit enrollment in areas where demand for teachers is low and to encourage enrollment in disciplines "where the market is demanding more graduates."[26] Elementary education majors will be limited to 1,100 and secondary education majors to 1,600. Departments scheduled to be cut sharply include social science which has a current enrollment of 279 and a quota of 116, and art which has 119 students and a quota of 76.

The university said these quotas are expected to be met through attrition. Areas in which quotas are being set above current enrollment include business education, general science, and mathematics. Michigan State's action followed similar steps by colleges and universities in other states. In Illinois, for example, six public institutions were asked to reduce the production of teachers by 10 to 20 percent.[27]

In California's teacher preparation institutions, the question of whether or not to limit enrollment in the face of teacher surpluses, is, of course, another policy issue we have encountered in this study, and therefore beyond the scope of this report. However, we would urge caution in the method or process by which such enrollment limitation policies are implemented, if at all, since there are dangers inherent in the manner in which these reductions typically come about.

Schools of education, if forced to reduce the number of students they enroll and graduate, may adopt a policy of: (1) "first come, first served," or (2) making entry requirements more difficult, thereby discouraging the less capable students. Whatever the particular enrollment policy or procedure to be adopted, if one is in fact made in California's private and public teacher preparation institutions, we strongly believe that great care must be taken to ensure that such policies encourage the highest quality teacher prospects to continue

the pursuit of a teaching career, while the total number of prospective teachers is curtailed.

Finally, we must express our surprise over the lack of sophistication in forecasting methodology demonstrated by the National Education Association, and to a lesser extent, by the California Department of Human Resources Development (HRD). In the case of HRD, since they used the Department of Labor's national economic and other growth rate assumptions and procedures in 1969 to derive teacher demand data in California, rather than the California Department of Finance's projections of school-age enrollments from 1970-1980, it is understandable why their teacher demand predictions were inadequate.

However, it was not until late July, 1971, that the National Education Association appears to have become aware of or alarmed by the current and projected surplus of teachers. Until that time, all of NEA's language, quality criteria, and analysis focused on a continuing teacher shortage. This appears to have been a surprising oversight, since the NEA is the principal analyst of teacher supply and demand in the United States. As one researcher said: "A simple extrapolation of their trend data for only several years ahead would have revealed the striking surplus that we are now experiencing."[28]

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E. SOCIAL WORK

Introduction

The relationship between supply and demand in the field of social work has some special problems for a number of reasons. It is difficult to define the field of social work clearly. Different sources we have examined include different occupations under the general category of social work. Many persons working in the field do not have a degree in social work, but have entered the profession with a baccalaureate in the humanities, liberal arts, or education. As a result, it is difficult to estimate the supply of workers by the usual procedure of using data on degrees awarded and enrollment in social work educational programs. The relationship between social need and job-market demand is particularly difficult to differentiate in this field. Social work as a profession is responsive to social problems, rather than to such factors as economic growth or industrial expansion, the criteria used by the U. S. Department of Labor to project job-market demand. Public recognition of a new social need can, therefore, have a profound effect on the employment situation in social work.

Social work is also of special concern because of what appears to be a growing interest by youth of college age in careers that emphasize working with people. This poses the serious issue of individual student choice of careers versus having some external control over the educational "pipeline" when surpluses exist and threaten to become worse in the future.

California Supply of Social Workers

Table 18 shows the actual and estimated supply of social workers with baccalaureate, Master's, and Ph.D. degrees produced by the independent colleges and universities, the California State University and Colleges, and the University of California for academic years 1967-68 through 1970-71. Data from the community colleges are not included since graduates by student major are aggregated in a general "Social Science" category. Data on degrees awarded by the independent colleges and universities were not available for academic years 1967-68 and 1968-69. The degree production for these years was estimated from the degree data available from the University of California.

The number of degrees in social work awarded by the independent colleges and universities for academic years 1967-68 and 1968-69 were estimated by using the proportion of net changes to degrees awarded at the University of California for academic years 1969-70 and 1968-69. Thus, the proportion of 30 to 351 at the University of California for 1969-70 gives us a proportion of 11 to 128 at the independent colleges and universities for the same year; and the proportion of 24 to 321 at the University of California for the preceding year gives us a proportion of 9 to 117 at the independent colleges and universities for 1968-69. Using these estimates, we have filled in the missing cells in Table 18. All estimates are identified by asterisks.

TABLE 18

SUPPLY OF SOCIAL WORKERS, ALL DEGREES, UNIVERSITY OF CALIFORNIA, CALIFORNIA STATE UNIVERSITY AND COLLEGES, INDEPENDENT COLLEGES AND UNIVERSITIES, ACTUAL AND ESTIMATED

1967-68 THROUGH 1970-71

Academic Year	Independent Colleges and Universities	Net Change	% Change	State Univ. and Colleges	Net Change	% Change	Univ. of Calif.	Net Change	% Change	Total Degrees	Net Change	% Change
1967-68	108*			643			297			1,048*		
1968-69	117*	9*	8.3*	654	11	1.7	321	24	8.1	1,092*	44*	4.2*
1969-70	128	11*	9.4*	866	212	32.4	351	30	9.3	1,345	253*	23.2*
1970-71	109	-19	-14.8	804	-62	-7.2	313	-38	-10.8	1,226	-119	-8.8
Total	462			Total 2,967			Total 1,282		Grand total	4,711*		
Three year Change:		1*	1.0*		161	25.0		16	5.4		178*	17.0*

Source: University of California, Office of Analytical Studies; California State University and Colleges, Office of Institutional Research; and Association of Independent California Colleges and Universities.

*Note: Estimated figures for the independent colleges and universities for academic years 1967-68 and 1968-69 are based on the proportion of net changes to degrees awarded at the University of California for academic years 1969-70 and 1968-69. Subsequent data in the table based on these estimates are identified by an asterisk.

Using these procedures, the grand total of all degrees produced in social work for the three segments of higher education in California for the academic years 1967-68 through 1970-71, including both actual and estimated data, is 4,711, as shown in Table 18.

We turn now to the problem of estimating degree production in social work for academic years 1971-72 through 1974-75. Although the change for the years for which we have degree data shows a total 17.0 percent increase, we cannot assume this increase will continue for the next four-year period because of the declines in degrees awarded by each of the segments in 1970-71, as shown in Table 18.

The available enrollment data for the California State University and Colleges from 1967-68 through 1971-72 show a decline from 1967-68 to 1969-70 followed by an increase in 1970-71 and 1971-72 (see Table 19).

TABLE 19

ENROLLMENT IN SOCIAL WORK, UNDERGRADUATE AND GRADUATE, CALIFORNIA STATE UNIVERSITY AND COLLEGES

1967-68 THROUGH 1971-72

Academic Year	Under-graduate	Graduate	Total	Net Change	% Change
1967-68	1,978	358	2,336		
1968-69	1,761	424	2,185	-151	-6.5
1969-70	1,733	394	2,127	-58	-2.7
1970-71	2,030	434	2,464	337	15.8
1971-72	2,597	647	3,044	580	23.5
			Four year change:	708	30.3

Source: California State University and Colleges, Office of Institutional Research, April, 1972.

These data indicate that the decline in degree production shown in Table 18 for academic year 1970-71 will continue for two more years, reflecting the declining enrollments in 1968-69 and 1969-70 shown in Table 19, and then increase in 1973-74 and 1974-75, reflecting the increase in enrollment in 1970-71 and 1971-72.

The rates of increase in enrollment in 1970-71 and 1971-72 are especially striking, 15.8 and 23.5 percent respectively. The trend beginning in 1970-71 is sharply upward, indicating a sharp increase in degree production by 1973-74.

Data on enrollment in "social welfare" is available from the University of California for academic years 1967-68 through 1969-70 (see Table 20). These data show a relatively slow net increase, with an 11.6 percent overall increase for the two year period.

TABLE 20

ENROLLMENT IN SOCIAL WELFARE, UNDERGRADUATE AND GRADUATE, UNIVERSITY OF CALIFORNIA

1967-68 THROUGH 1969-70

Academic Year	Under-graduate	Graduate	Total	Net Change	% Change
1967-68	5,669	584	6,253		
1968-69	5,824	694	6,518	265	4.2
1969-70	6,095	881	6,976	458	7.0
			Two year change:	723	11.6

Source: University of California, Office of Analytical Studies, April, 1972.

Although we have no data on enrollment in the community colleges in social work, per se, we do have information on enrollment in "Social Science". These data support the trend in Table 19 showing increasing interest by students in the social sciences, a 32.0 percent increase in the period shown (see Table 21).

This increase is even more dramatic when one compares the enrollment of 40,436 in the social sciences in 1969 with the enrollment of 19,562 in 1962 (not shown in the table), an increase of 20,874 or over 100 percent.

It is assumed that the increase in social work and social welfare enrollment at the California State University and Colleges and the University of California, shown in Tables 19 and 20, is also occurring at the independent colleges and universities. The rate of increase at the latter segment is assumed to be the same as the University of California, or 11.6 percent. We shall also assume that the 11.6 percent change for the University of California would still be the same if we had enrollment data for 1970-71 and 1971-72. These estimates are probably low.

TABLE 21

ENROLLMENT BY STUDENT DECLARED MAJOR, IN SOCIAL SCIENCE, CALIFORNIA COMMUNITY COLLEGES

FALL 1967-FALL 1969

Year (Fall)	Enrollment	Net Change	% Change
1967	30,641		
1968	35,573	4,932	16.1
1969	40,436	4,863	13.7
	Two year change:	9,795	32.0

Source: Office of the Chancellor, California Community Colleges, April, 1972.

We have estimated the increase in degree production during academic years 1971-72 to 1974-75 by using the rate of increase in enrollment for each segment for the period 1968-69 to 1971-72. The rates are estimated at 11.6 percent for the independent colleges and universities and the University of California and an actual 39.3 percent for the California State University and Colleges. The total actual and estimated degrees in social work awarded from 1967-68 to 1970-71 by the independent colleges and universities is 462; it is 2,967 for the State Colleges for the same years; and it is 1,282 for the University of California.

Taking the percentages of the total degrees awarded by each of the segments, we obtain 54 degrees for the independent colleges and universities; 149 for the University of California; and 1,166 for the State Colleges. Adding these estimated increases in degrees awarded to the totals obtained for the period from 1967-68 to 1970-71, the result is 516 for the estimated degrees awarded by the independent colleges and universities for the period from 1971-72 to 1974-75; 4,133 for the State Colleges; and 1,431 for the University of California. In the period from 1971-72 to 1974-75, therefore, the three segments would produce an estimated 6,080 degrees in social work. For the entire period from 1967-68 to 1974-75, the total number of degrees awarded based on these estimates and assumptions would be 10,791. Attrition rates have not been considered in making the estimates above since such data were not available.

California Demand for Social Workers

The official source of data on the demand for workers, *California Manpower Needs to 1975*, states that the total demand for social workers from 1968 to 1975 will be 9,600.[1] This figure includes 6,100 new jobs created by "industrial" expansion and 3,500 replacement needs from deaths and retirements.[2]

If we compare our projected supply of 10,791 degrees for the same period of time, 1968 to 1975, with the official demand of 9,600, the result is a surplus of 1,191.

As noted in the previous sections of this study, the demand figure cannot be regarded as reliable due to the erroneous economic growth assumptions on which it was based. Social work, however, should not be as susceptible to economic downturns as engineering and chemistry since it is almost entirely supported by government funds at Federal, State, and local levels. On the other hand, of course, a decline in such government support would impact on demand. Unfortunately, we have no data on the level of support being provided by government sources for social workers, nor do we have any data on unemployment rates among social workers.

In light of the limited data available to us, we conclude that the surplus of social workers will increase sharply in 1973-74 and become still larger in 1974-75. This is based on rising enrollments, especially at the California State University and Colleges. It is also based on newspaper reports of cutbacks in support for social welfare programs. These cutbacks are coming at a time when students are showing an increasing interest in people-related jobs. A counselor at a two-year community college where a career development program has been established reports that large numbers of students are majoring in fields where there are few job opportunities, such as forestry, psychology, and social work.[3] He predicts that by 1975 there will be "thousands" of people looking for jobs as social workers but there will not be any openings. This evaluation of the situation is supported by the Director of Admissions at the California Institute of Technolgy who explained the 20 percent drop in freshman applications at his institution by stating that many young people have a negative attitude toward science and technology and feel it is better to go into social science where they can work with people.[4]

Problems in Estimating Supply and Demand for Social Workers

Definition of Social Work

The field of social work is particularly difficult to define. Definitions of workers in the field range from only professionals with at least a Master's degree in social work to a large variety of occupations, such as clergymen, parole officers, welfare investigators, and prison attendants, with or without college degrees.[5] The widespread use of subprofessionals also makes it difficult to define

the field with any precision. In our literature review we found that in some cases social work was treated as a distinct field or category of employment or study and in other cases it was lumped together with "social and welfare workers", as in *California Manpower Needs to 1975*.[6] In the data on degrees and enrollment we obtained for this study from the segments, the State universities and colleges used the category "social work" while the University of California and the independent colleges and universities used the category "social welfare". We do not know if these different categories encompass the same or different types of educational programs.

A major study of supply and demand in social work points out that it is a field in which most of those who enter it do not have a degree in social work.[7] This study also notes that the supply of entrants into the field cannot be estimated merely from degree data or enrollment in social work programs because entrants also come in after obtaining degrees in the humanities, social sciences, or education.[8] These considerations lead us to the conclusion that our estimate of the supply of social workers based on degree data and student enrollment in the field is at best, only a crude measure of the possible supply.

Demand Versus Need for Social Workers

Social work is a field in which social need and job market demand are especially difficult to differentiate. Social workers are almost entirely dependent for employment upon government funding at various levels. The demand, therefore, cannot be based upon the growth of the economy as is the case with most of the occupations treated by the U. S. Department of Labor in its projections to 1975 and 1980.

Since our society abounds with social problems of many kinds - drug abuse, venereal disease, racial unrest, high unemployment, especially among Negro youth, low educational achievement in urban ghetto schools, the neglect of the aged, and many others - future demand for social workers is difficult to gauge with any reliability. A new political administration at any level - city, county, State, and Federal - may transform a social need into a demand for social workers overnight. As noted in *Human Resources and Higher Education*, "if laws and social institutions are modified, many more social workers may be needed than can now be foreseen."[9] By the same token, curtailment of social programs by government administrations can create serious unemployment among social workers overnight. It is our conclusion that in the field of social work, more than many others, the past is not likely to provide a very reliable guide to the future.

Individual Student Choice Versus Job Demand

A study of the field of social work found "that persons who had value preferences for people over things and who wanted to help others were drawn to social work...."[10] We have noted in this section on social work and in our previous sections on other occupations that

students appear to be showing considerable interest in fields related to working with people. Those making these decisions do not appear to be making their career choices based upon known career opportunities.

If there is, indeed, a current surplus of social workers and a still larger one immediately ahead, should educational programs in social work be reduced or terminated because there may be no job market for graduates? Who shall make this decision? Who shall decide that young people interested in careers where they can work closely with others shall not have the opportunity to study for such careers? Is the job market the only basis for opening or closing the educational pipeline to would-be social workers?

As we have noted, past demand is a poor basis for estimating future demand in the field of social work. It is our conclusion that individual choice should remain, as it has been traditionally in the United States, the basis for enrollment in social work programs. But students who make such choices should be fully informed of the career-related hazards of making such a choice. Job market information, to the extent it can be ascertained, should be part of the counseling every student should receive.

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F. FINE ARTS

Introduction

As in the case of social work, the study of the relationship between supply and demand in the fine arts is made especially difficult by the lack of a commonly accepted definition of the field. Among the educational segments of higher education in California, it is not clear that a common definition of the "fine arts" is used for recording degrees and enrollment. This makes estimating supply hazardous. The total supply is also difficult to estimate because many people employed in the arts either do not have college degrees or have degrees from unrelated professions. It is also difficult to relate the supply of degrees as defined by the segments, such as the University of California, with job demand as defined by the U. S. Department of Labor, which includes in its demand figure occupations not included in the University of California's definition of the fine arts.

The field of fine arts is of special importance in this study of supply and demand among selected professions. It is a field in which students are expressing a growing interest, in contrast with a declining interest in engineering. This interest is growing despite the fact that the fine arts include occupations that have been traditionally underpaid, and characterized by underemployment and a relatively high rate of unemployment compared with other professions. There is little to suggest that the job market for graduates of fine arts programs will increase in the future sufficiently to absorb the growing number of graduates in such programs. A brief analysis of the field highlights the serious problem of an imbalance between supply and demand and raises difficult policy questions associated with establishing some form of control over the supply to prevent a critical unemployment situation in the future. A study of supply and demand in the fine arts strikes at the heart of the question of why today's students are going to college.

California Degree Supply in the Fine Arts

Table 22 shows the actual and estimated supply of persons with baccalaureate, Master's, and Ph.D. degrees in the fine arts produced by the independent colleges and universities, the California State University and Colleges, and the University of California for academic years 1967-68 to 1970-71. Data from the community colleges are not included since graduates by student major in the fine arts are aggregated with majors in the liberal arts. Data on degrees awarded by the independent colleges and universities were not available for academic years 1967-68 and 1968-69. As in the other fields studied, the degrees awarded for these years were estimated from the degree data available from the State University and Colleges and the University of California.

To estimate the degrees awarded by the independent colleges and universities for 1967-68 and 1968-69, we have used the same number of degrees for the same years awarded by the University of California.

TABLE 22

SUPPLY IN FINE ARTS, ALL DEGREES, UNIVERSITY OF CALIFORNIA, CALIFORNIA STATE UNIVERSITY AND COLLEGES, INDEPENDENT COLLEGES AND UNIVERSITIES, ACTUAL AND ESTIMATED

1967-68 THROUGH 1970-71

Academic Year	Independent Colleges and Universities	Net Change	% Change	State Univ. and Colleges	Net Change	% Change	Univ. of Calif.	Net Change	% Change	Total Degrees	Net Change	% Change
1967-68	940*			1,924			940			3,804*		
1968-69	1,304*	364*	38.7*	2,395	471	24.5	1,304	364	38.7	5,003*	1,199*	31.5*
1969-70	1,442	138*	10.6*	2,720	325	13.6	1,611	307	23.5	5,773	770*	15.4*
1970-71	1,377	-65	-4.5	3,042	322	11.8	1,685	74	4.6	6,104	331	5.7
Total	5,063		Total	10,081		Total	5,540		Grand total.	20,684*		
Three year change:		437*	46.5*		1,118	58.1		745	9.3		2,300*	60.5*

Source: University of California, Office of Analytical Studies; California State University and Colleges, Office of Institutional Research; and Association of Independent California Colleges and Universities.

*Note: Estimated figures for the independent colleges and universities for academic years 1967-68 and 1968-69 are the same as actual degrees awarded for the same years by the University of California. Subsequent data in the table based on these estimates are identified by an asterisk.

This procedure is based on the fact that the actual degrees awarded by these two segments are roughly similar. The procedure will give us a high estimate for the independent colleges and universities, as the actual data in Table 22 indicate, but it is a usable estimate for our purposes.

The grand total of all degrees awarded in the fine arts for the three segments of higher education in California for academic years 1967-68 to 1970-71, including both actual and estimated data, is 20,684.

We now address the problem of estimating degree production in the fine arts for academic years 1971-72 to 1974-75. The years for which we have actual and estimated degree data, 1967-68 to 1970-71, show a large overall increase of 60.5 percent. However, the rate of increase is declining, especially in the independent colleges and universities. The question to resolve is whether this decline is likely to continue in the next four years.

The data available on enrollment in the fine arts, both undergraduate and graduate, at the University of California for academic years 1967-68 to 1969-70 are shown in Table 23.

TABLE 23

ENROLLMENT IN FINE ARTS, UNDERGRADUATE AND GRADUATE, UNIVERSITY OF CALIFORNIA

1967-68 THROUGH 1969-70

Academic Year	Undergraduate	Graduate	Total	Net Change	% Change
1967-68	79,265	5,749	85,014		
1968-69	80,697	6,786	87,483	2,469	2.9
1969-70	92,291	7,467	99,758	12,275	14.0
			Two year change:	14,744	17.3

Source: University of California, Office of Analytical Studies, April, 1972.

These data show no indication of a decline in student interest in this field. Rather, they show an increasing interest, especially marked in 1969-70. For the entire period, enrollment is up a substantial 14,744, representing a 17.3 percent change. The upward trend from 1968-69 to 1969-70 is supported by data from the California State University and Colleges for the following years, 1970-71 and 1971-72 (see Table 24).

The available data on enrollment for the California State University and Colleges from 1967-68 to 1971-72 also show no indication of a decline in interest by students in the fine arts (see Table 24). Rather, the data show a steadily increasing enrollment with one slight dip in 1969-70, and a net change of 5,676 in enrollment, up a strong 53.0 percent over the period.

Unfortunately, available data on student enrollment at the community colleges aggregate fine arts and liberal arts. However, we are including these data here to show the general interest of students in these areas (see Table 25). Enrollment is up a substantial 20,045 from 1967 to 1969, an increase of 27.2 percent. This increase in student interest in the liberal and fine arts is even more pronounced if we compare the 29,616 enrolled in the fall of 1962 (not shown in the table) with the 93,716 enrolled in the fall of 1969. This is an increase of 64,100, or 216.4 percent.

TABLE 24

ENROLLMENT IN FINE ARTS, UNDERGRADUATE AND GRADUATE, CALIFORNIA STATE UNIVERSITY AND COLLEGES

1967-68 THROUGH 1971-72

Academic Year	Under-graduate	Graduate	Total	Net Change	% Change
1967-68	9,371	1,342	10,713		
1968-69	10,791	1,427	12,218	1,505	14.0
1969-70	11,517	1,549	13,066	848	6.9
1970-71	13,012	1,443	14,455	1,389	10.6
1971-72	14,346	2,043	16,389	1,934	13.4
			Four year change:	5,676	53.0

Source: California State University and Colleges, Office of Institutional Research, April, 1972.

TABLE 25

GRADED ENROLLMENT BY STUDENT DECLARED MAJOR,
CALIFORNIA COMMUNITY COLLEGES

FALL 1967 TO FALL 1969

Year (Fall)	Liberal and Fine Arts	Net Change	% Change
1967	73,671		
1968	83,714	10,043	13.6
1969	93,716	10,002	11.9
	Two year change:	20,045	27.2

Source: Office of the Chancellor, California Community Colleges, April, 1972.

We assume that the increase in enrollment at both the California State University and Colleges and the University of California, shown in Tables 23 and 24, is also occurring at the independent colleges and universities. The rate of increase at the latter segment is assumed to be the same as the race of increase at the University of California or 17.3 percent. We also assume that the 17.3 percent change for the University of California would remain the same if we had enrollment data for 1970-71 and 1971-72.

We have estimated the increase in degree production during academic years 1971-72 to 1974-75 by using the rate of increase in enrollment for each segment for the period 1968-69 to 1971-72. The rates are an estimated 17.3 percent for the independent colleges and universities and the University of California, and an actual 34.1 percent for the State colleges. The total actual and estimated degrees in the fine arts awarded from 1967-68 to 1970-71 by the independent colleges and universities, as shown in Table 22, is 5,063; 5,540 for the University of California for the same period; and 10,081 for the State colleges. Taking the percentages of the degrees awarded by each of the segments, as noted above, we obtain 876 degrees for the independent colleges and universities; 958 degrees for the University of California; and 3,438 for the State colleges. Adding these estimated increases in degrees awarded to the total obtained for the period from 1967-68 to 1970-71, we have 5,939 for the estimated degrees awarded by the independent colleges and universities for the period from 1971-72 to 1974-75; 6,498 for the University of California; and 13,519 for the State colleges. In the period from 1971-72 to 1974-75, therefore, the three segments would produce an estimated 25,956 degrees in the fine arts, if present trends continue. From

1967-68 to 1974-75, the total number of degrees awarded based on these estimates and assumptions would be 46,640. Attrition rates have not been considered in making the estimates above since such data were not available.

California Demand for Fine Arts Graduates

In *California Manpower Needs to 1975*, the official source of data on the demand for workers which we have been using, there is no occupational category called "fine arts". There is a category called "artists, athletes, and entertainers".[1] The demand for this category is estimated at 31,300 from 1968 to 1975 with 18,100 new jobs created by industrial expansion and 13,200 replacement needs from deaths and retirements.

There is obviously a problem of the relationship between the supply of degrees categorized as "fine arts" and the demand categorized in a different way with a different aggregation of occupations subsumed under it. Table 26 suggests the extent of the problem. The table shows how three different organizations have grouped roughly similar occupations. We do not have information on what the California State University and Colleges and the independent colleges and universities include under the category "fine arts", hence they are not included in the table.

The occupations listed by the U. S. Department of Labor, as shown in Table 26, are more numerous and more comprehensive than those listed by the University of California. In addition to athletes and sports instructors and officials, it also includes teachers of art and dancing. Thus, the estimate of demand for 1968-1975 in *California Manpower Needs to 1975* should be much larger than any estimate of demand that would be based only on the occupations listed by the University of California.

It should be noted again that the official demand estimate of 31,300 must be considered high because of the erroneous assumptions about economic growth and industrial expansion on which the figure is based. This high estimate is more than balanced, however, by the broader definition of the field.

If we compare our supply estimate of 46,640 based on a limited definition of the fine arts as used by the University of California, to the official demand estimate of 31,300, based on a much broader definition of the same field, the result is a large surplus of 15,340 and, as the above qualifications suggest, the true surplus is probably higher still.

Problems in Estimating Supply and Demand in the Fine Arts

Definition of the Fine Arts

We have already noted that it is difficult to compare supply and demand when there is no common agreement on the definition of the supply

TABLE 26

OCCUPATIONS INCLUDED IN "FINE ARTS," "PERFORMING ARTS," AND "ARTISTS, ATHLETES, AND ENTERTAINERS," BY THE UNIVERSITY OF CALIFORNIA, THE COMMISSION ON HUMAN RESOURCES AND ADVANCED EDUCATION,[2] AND THE U. S. DEPARTMENT OF LABOR

Organization	Category	Occupations
University of California	Fine Arts	art dance dramatic art music theatre arts visual arts
Commission on Human Resources and Advanced Education	Performing Arts	actors artists authors dancers musicians
U. S. Department of Labor	Artists, Athletes, and Entertainers	actors and actresses artists and art teachers authors athletes dancers and dancing teachers entertainers musicians sports instructors and officials

and demand categories. We would hope, however, that at least within the educational sphere there would be a commonly used definition of the "fine arts". Such is, unfortunately, not the case.

Table 27 shows the comparable fields listed under the category of "fine arts" by the University of California and the Higher Education General Information Survey (HEGIS) category of "fine and applied arts" used by the National Center for Educational Statistics.[3] While the fields listed in the two categories are very similar, with the HEGIS fields being broken out in more detail, the inclusion of the applied arts with the fine arts in the HEGIS system would make it difficult to compare HEGIS supply data with similar data from the University of California.

TABLE 27

OCCUPATIONS INCLUDED IN "FINE ARTS" AND "FINE AND APPLIED ARTS" BY THE UNIVERSITY OF CALIFORNIA AND THE HEGIS

Organization	Category	Occupations
University of California	Fine Arts	art dance dramatic art music theatre arts visual arts
National Center for Educational Statistics (HEGIS).	Fine and Applied Arts	fine arts, general art (painting, drawing, sculpture) art history and appreciation music (performing, composition, theory) music (liberal arts program) music history and appreciation (musicology) dramatic arts dance applied design (ceramics, et al.) cinematography, photography

College Degrees as a Measure of Supply

The true supply of people in the fine arts cannot be limited only to those with college degrees. Those who enter the fine arts occupations have, on the average, two years less formal education than professionals in general.[4] Artists, dancers, and musicians, for example, do not require a degree to work in their fields. Also, many who work in the fine arts have degrees in unrelated fields. If we include those without degrees and with degrees in unrelated fields as part of the available supply, the surplus we have identified above would be still larger.

The use of degree data to estimate supply in the fine arts is further complicated by the fact that national data show that only about one-fourth of college graduates trained in fine arts actually enter the field.[5] However, the available data do not make clear whether this is the result of individual student choice or the lack of jobs.

Unemployment in the Fine Arts

Part-time work is far more common in the fine arts than in other occupations and unemployment rates are higher. In 1959, for example,

national data for the category, "performing arts", show that unemployment was twice as large as other professions.[6]

Our data suggest this unemployment rate may be even higher in the future. Data on the performing arts compiled by the Commission on Human Resources and Advanced Education show that employment in the arts grew only half as fast as all other professions in the 1950-60 decade.[7] We have no data that indicate this difference in growth rate is continuing, although current unemployment among actors and authors associated with the motion picture industry is known to have grown due to changes in regulations governing television programming.

The Commission on Human Resources and Advanced Education concludes from its review of national data on the fine arts that this field presents a picture "of a slow-growing, underpaid and underemployed group of professional fields..."[8] We should also note that in 1960, of those who had majored in the fine arts, only 18 percent were working in these fields while 52 percent were employed as teachers.[9] This is an ominous note since unemployment in the fine arts during a period when there is also unemployment in teaching would close off a major avenue of occupational mobility which has served as a manpower adjustment mechanism in the past. Without teaching as an alternative, what job market is the fine arts major suited for if the manpower surplus in this field should grow as it appears it will?

Conclusions

The data on degrees awarded and enrollment in the fine arts indicate a growing interest by students in this field. This finding, in conjunction with a similar growth of interest in social work, is in sharp contrast with evidence of declining student interest in engineering. This polarization of interests poses a serious problem for a society such as ours in which economic and industrial growth are dependent upon developments in science and technology.

While there are difficulties comparing supply with demand in the fine arts due to the lack of a commonly accepted definition of this field, our data show, nevertheless, a large surplus of students obtaining degrees in relation to any possible job market. We estimate a surplus of at least 15,340 by 1975 and recognize the possibility that the actual surplus may be greater. The surplus beyond 1975 is expected to become still larger if the present upward enrollment trend continues.

The fine arts constitute a group of occupations that are not consistently identified by different groups such as the University of California, the Commission on Human Resources and Advanced Education, and the U. S. Department of Labor. This makes estimating the relationship between supply and demand particularly difficult. If supply and demand studies in this field are to become more rational, a commonly accepted definition of the fine arts must be established and then

used by all organizations concerned. The HEGIS definition appears to be a reasonable one and we favor its adoption not only by higher education institutions in California, but also by the U. S. Department of Labor. Obviously, the supply of students with degrees in the fine arts cannot be compared rationally with a demand for athletes and sports instructors and officials.

The interest of students in the fine arts appears to be unrelated to job-market considerations. Data for the decades of the 1950's and 1960's show relatively high unemployment rates compared with other professions. Our data on estimated surpluses indicate the unemployment rate will probably increase from 1972 to 1975 and become larger after 1975.

It is difficult to see how a problem of this nature can be resolved. Whereas government sponsored programs may alter the demand picture in engineering, chemistry, and social work, there is little possibility of this happening in the fine arts. Do educational planners and decision makers have the right to close off the educational "pipeline" in the fine arts because the existing or possible future job-market cannot absorb the graduates of such educational programs? This is a question only policy makers at the highest educational levels can answer.

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G. OTHER MANPOWER DEVELOPMENT PROGRAMS

Introduction

In the previous section six occupations were selected for supply and demand analysis and conclusions were made regarding present trends and the extent of manpower imbalanced that are likely to occur in the future if these trends continue. In the majority of cases, the job entry level requirements of these occupations specified at least the baccalaureate degree. Some occupations, like law and teaching, required advanced degrees.

In addition to supply and demand analyses involving the four segments of higher education and various levels of degree preparation, statewide system planning for higher education should also be concerned with the nature and extent of California's other resources and capabilities for developing highly trained manpower. These include State agencies and non-degree granting educational institutions which have significant roles in manpower planning and development in California.

As outlined earlier in this report, our study directed considerable attention to the identification of these agencies and institutions and both interview data and published documentation were obtained from a number of them. The principal purposes of data collection activities with these groups were to describe their various manpower development roles and to identify the existing interrelationships among them, particularly as they impact on statewide system planning for higher education in California.

The major State agencies and educational institutions that we believe are especially significant resources as part of the State's total manpower development capabilities are the following: California Chamber of Commerce; California Advisory Council on Vocational Education; California State Vocational Education Area Planning Committees; California Manpower Coordinating Committee; Cooperative Area Manpower Planning System (CAMPS); Regional Occupational Centers and Programs; California Department of Education, Division of Vocational Education; Office of the Governor, Task Force on Occupational Education; Office of the Chancellor, California Community Colleges; California Department of Human Resources Development; California Human Relations Agency; California Department of Industrial Relations, Division of Apprenticeship Standards; California Apprenticeship Council; Assembly, California Legislature, Select Committee on Manpower Development; and the large number and variety of proprietary schools in California which annually produce thousands of highly trained, post-secondary school level manpower for entry into the State's labor force.

Unfortunately, because of the extremely limited time available for this study it was not possible to analyze and describe the functions of each of these state government agencies and educational institutions, or to examine the interrelationships which exist among them. We consider this a limitation of our study, since an understanding of these functions and interrelationships is a significant

variable because it has a sizeable impact on the development of more effective statewide system planning of higher education in California. This is an important area requiring additional study and consideration and a special, in-depth research effort.

However, within the limited time constraints of our study, we were able to gather sufficient data concerning the functions and responsibilities of several of these groups. A brief listing and discussion of these State manpower development agencies and educational institutions follows.

Assembly, California Legislature, Select Committee on Manpower Development

This Committee appears to be extremely active in sponsoring and advancing a large number and variety of legislative bills related to post-secondary manpower development programs, career education, management information systems for vocational and occupational education planning, preventative and remedial manpower programs, and development of planning-programming-budgeting systems criteria for use by vocational area planning agencies. At present, the Select Committee has bills in various stages of progress in the State legislature relative to manpower development effectiveness (Assembly Concurrent Resolution, Number 22); regional guidance resource centers (Assembly Bill, Number 814); student internship programs at the vocational-technical level (Assembly Bill, Number 1642); and the establishment of the California Professional Internship Council (Assembly Bill, Number 1661). This bill builds upon the concepts inherent in the Public Service Internship Program and the University of California and California State University and Colleges "external degree programs."

The principal thrust of these bills is on manpower development programs (career education) for high school and post-secondary youth; non-degree holders who are interested in entering a variety of trades and technical occupational fields. As such, the bills focus on the development of marketable skills for employment in the labor market. Many of the Committee's bills also involve various segments of higher education and departments in the state government. Assembly Concurrent Resolution, Number 22, for example, involves the specification of criteria for manpower development by the Department of Human Resources Development, the Department of Education, the Board of Governors of the California Community Colleges and the Department of Social Welfare.

The Select Committee's major activities involve the sponsorship and implementation of manpower development programs that have direct impact in a variety of ways upon the other public and private segments of higher education in California. For this reason, the Committee's legislative plans and interests should be carefully reviewed and monitored continuously by all four segments of higher education. Close contact with the Committee should also be maintained by the Coordinating Council for Higher Education to ensure effective continuity and coordination of effort.

California Department of Human Resources Development

The passage of Assembly Bill 1463 (AB 1463) in 1968 by the California Legislature was considered landmark legislation because of its creation of the State Department of Human Resources Development as a comprehensive manpower agency with a clear priority to serve the disadvantaged.[1] The bill also mandated greater state involvement in the planning and coordination of all publicly funded manpower programs operated within the State of California.

In establishing the Department of Human Resources Development (HRD), the legislature intended to create an umbrella agency responsible for administering all job training, placement, and related services.[2] It includes the following state agencies: State Department of Employment, State Office of Economic Opportunity, State Service Center Program, and the Commission on Aging.

In the early developmental stages of the legislation, it was planned to also include both the Department of Rehabilitation and the Division of Apprenticeship Standards of the Department of Industrial Relations in order to better coordinate and utilize existing resources, as well as to redirect the Division's efforts to serve more disadvantaged and minority groups. As a result of interested pressure groups, the provisions of AB 1463 concerning both of these areas were changed by amendment and HRD now has very little influence over these programs.[3]

Assembly Bill 1463 also created a Job Training and Development Services Advisory Board which included representatives from the state legislature, labor, public education, business, agriculture, apprenticeship training, private vocational education, and members from economically disadvantaged areas. The Board has broad responsibilities for reviewing statewide manpower problems and in developing recommendations for administrative, executive and legislative action.

Cooperative Area Manpower Planning System

The Cooperative Area Manpower Planning System (CAMPS) is organized through the State of California's Manpower Coordinating Committee, thirteen CAMPS Area Committees, and the Non-Metropolitan (Balance-of-State) Area. The Area Committees include 87.4 percent of the population of the State, and annually prepare a statewide Comprehensive Manpower Plan. Also contributing to the Plan are Community Action Agencies and offices of the Department of Human Resources Development.[4]

The CAMPS program is attempting to address the problems of unemployment and underemployment for thousands of disadvantaged Californians in all areas of the State, due to lack of resources for manpower programs, as well as economic development to provide more employment opportunities.[5] CAMPS provides a number and variety of programs for the disadvantaged which are specifically designed to achieve productiveness through job rehabilitation.

California Department of Industrial Relations, Division of Apprenticeship Standards

Apprenticeship is a system of training skilled craftsmen through "learning while earning" and "learning by doing." It combines training on the job with related supplemental classroom instruction in a public school. Since an apprentice receives his training on the job, a person does not become a registered apprentice in California until he has been hired by an employer approved for such training by the Administrator of Apprenticeship, through the Department of Industrial Relations, Division of Apprenticeship Standards.[6]

Although formal apprenticeship programs approved by the State of California are a prime mode of training skilled craftsmen, such programs do not constitute the sole means of training skilled workers in the State. Some training programs conducted by large private companies and by the government are not registered with the State. Estimates are not available of the number of persons being trained under such programs in California or of their distribution by ethnic group.

The Shelley-Maloney Apprentice Labor Standards Act, which established the apprenticeship program in California, was enacted in 1939. It created a policy-making body, the California Apprenticeship Council, composed of 16 members, 14 of whom are appointed by the Governor. Six of the representatives are chosen from employers, six from employee organizations, and two from the general public. The Director of the Department of Industrial Relations is named by law as Administrator of Apprenticeship and serves, along with the Chief of the Bureau of Industrial Education of the Department of Education and the designee of the Chancellor of the California Community Colleges, as an ex officio member of the Apprenticeship Council. The chief of the Division of Apprenticeship Standards serves as secretary to the Council.[7]

Apprenticeship in California is voluntary, both on the part of the person being trained and the employer furnishing the training, except that employers holding State and local public works contracts must, by law, employ at least one apprentice for every five journeymen. The contents of the training programs, called "apprenticeship standards," are established by "program sponsors"--interested employers, employer associations and labor unions--and approved by the Administrator of Apprenticeship. The standards contain a training outline which details the major work processes an apprentice must master, and specify the approximate time to be spent on each process. The standards also provide for related and supplemental school instruction; establish the ratio of apprentices to journeymen to be employed on the job; chart the required progression from apprentice to journeyman wages; and specify the minimum wages, hours and conditions under which an apprentice will be allowed to work.[8]

All apprentices and trainees must be selected by uniform, fair and impartial selection procedures without regard to race, religion,

color, national origin or ancestry. Joint apprenticeship and training committees are focusing their attention on recruitment of qualified persons from minority communities, as well as other segments of the population.

The accomplishments of the Division of Apprenticeship Standards from 1967 through 1971 are impressive. At present the Division lists 281 apprenticeable occupations and has increased the number of active registered apprentices from 20,595 in 1967 to over 30,000 in 1971 and the mix of minority apprentices from 14 percent to 19 percent.[9] The Division has also registered over 59,000 new apprentices during 1967-1971 and presented journeyman certificates to over 20,000 California youth. Finally, during 1967-1971 at an approximate cost of seventy to eighty dollars per apprentice and an additional thirty dollars for related instruction, the Division also approved 15,098 apprenticeship and other on-the-job training programs which enabled 19,549 California Vietnam veterans to benefit from receipt of $17,842,710 in supplemental training income, which is a substantial contribution to California's economy.[10]

Proprietary Schools in California

Under the sponsorship of the Carnegie Commission on Higher Education, a national survey of proprietary schools is currently in process. These schools are both non-profit and profit-oriented institutions in the private sector which offer a great number and variety of curricula, ranging from secretarial and business office training, computer programming and electronic data processing systems analysis, key punch operation, to supervisory and management training. As such, these schools represent another large source of highly trained manpower in the State.

In correspondence received from the Carnegie Commission's survey director, only partial statistical data were provided since the survey has only recently begun.[11] Complete lists of schools in several states which will be involved in the survey are now being developed. However, at present only the lists of schools in which students now receiving Veterans' benefits as of December, 1971 are available. In the nation there were 4,785 such schools enrolling 231,444 students receiving Veterans' benefits. There are also 25,786 employers who were providing on-the-job training to 75,837 veterans. In the State of California there were 620 proprietary schools with 24,581 veterans enrolled. The proportion of veterans to the total enrollment of these schools is unknown. As the survey director stated:[12]

> It is interesting to note that although California has a very long history of community colleges and presently has more community colleges in relation to its population than in any other state, it also has a much higher number of veterans-approved proprietary schools than any other state.

Approximately half of the 24,000 veterans enrolled in proprietary schools in California are enrolled in schools that are primarily correspondence schools. 1,700 are enrolled in business schools, 2,400 in aviation schools, 2,000 in broadcasting schools, 1,000 in technical institutes, between 300-400 in electronics and computing, and about 300 in beauty and cosmetology. The remaining veterans are scattered over a great variety of schools including medical-dental assistance, piano tuning, theater, advertising, motel management, peace officer training, photography, surveying and mapping, and diving.[13]

A preliminary report of the Carnegie Commission survey of proprietary schools is expected to be available by fall 1972. The survey will include private (profit and nonprofit) technical, business, vocational, and other special purpose schools in eight to ten selected states. The purpose of the survey is to obtain basic descriptive information on current enrollment, nature of programs, expenditure patterns, characteristics of faculty and student body, contractual relations with other educational institutions or agencies, and educational approaches and methods.[14] In addition to this basic descriptive material, an attempt will be made to obtain information concerning changes in these schools; such as changes in enrollment, changes in programs and methods, and the school director's views about problems facing these schools.

Conclusions

In the time available we were able to identify only a small sample of the many agencies and educational institutions that are involved in manpower planning and development in California. No attempt was therefore made to study in detail the functions and interrelationships that presently exist among these various groups. However, we derived some impressionistic conclusions which we feel have significance for statewide systems planning, particularly in terms of college educated manpower.

First, there exists within the State a framework for planning and coordinating manpower programs. In 1968, a single state agency, the Human Relations Agency (HRA), was created to coordinated, review, and in some cases deliver all job training, placement and related programs. HRA is the comprehensive manpower agency whose director is State CAMPS chairman and which encompasses Human Resources Development (HRD), Employment Security, Office of Economic Opportunity, Vocational Rehabilitation and Public Welfare. The HRA is the "super" department for all operating manpower agencies, with the exception of Vocational Education, and acts as the communications and policy link between the Governor's office and the line departments. The head of HRA is appointed by the Governor, and is also part of the cabinet.

In 1968, the main planning and operating agency, the Human Resources Department (HRD) was established. Direct line authority exists between the Governor and the Director. This agency encompasses the Division of Job Training, Development and Placement, State OEO,

other related units such as tax collections, and insurance payments division, Management Services and Farm Labor Services. These delivery services are also connected by direct line authority through appointees. Other agencies under HRD are the Department of Rehabilitation, Department of Social Welfare and the State Department of Education.[15]

Although a framework for manpower planning and development already exists within the State, the various programs we have examined appear to be fragmented, lacking in coordination, and frequently overlapping or conflicting in their direction and focus. Various agencies have different responsibilities for training a number of target groups for employment in the labor market or to reduce unemployment and underemployment in various areas of the State.

In several cases, manpower agencies seem to be competing for either additional authority or for State and Federal government funds to support their own programs. As a result, very little communication and coordination occurs among those groups. In fact, budget reallocations resulting from reorganization of responsibilities among various state departments result in losses in staff for one and increases in another. The net effect is, of course, disharmony and the encouragement of competition among manpower agencies. Since an overall, comprehensive state manpower policy does not exist, the various State agencies are planning and operating a wide variety of manpower training programs on their own, despite the fact that the Human Relations Agency is the designated comprehensive manpower agency in the State.

Second, the major thrust of the State's manpower planning and development efforts is devoted to serving the disadvantaged. We were unable to identify any operational programs, legislation, or financial support that were specifically addressed to the problems of college educated manpower in the State. The Manpower Policy Task Force recently commented on this problem when it stated:[16]

> Until recently, national manpower policies and programs have focused relatively little attention on the more skilled and better educated segments of the labor force. The effort to synchronize the numbers and qualifications of persons with baccalaureate and higher degrees with the need and demand for their services has had relatively low priority. Although the federal, state, and local governments through their financial support for colleges and universities and for low income students impact directly on the future supply of educated persons, the concept of "manpower," as operationally defined by the programs of the U.S. Department of Labor, has emphasized the training and placement of the disadvantaged members of the labor force. It does not detract from the importance of this latter objective to assert that a comprehensive manpower program must focus on the employment problems of individuals at all levels of occupational structure.

Finally, there is no provision in the State's manpower plan, or in any of its various manpower development programs for direct involvement of the Coordinating Council for Higher Education, the State agency for coordination and planning of higher education in California. In view of the present and projected supply and demand imbalances among college educated manpower in California that we have discussed earlier, we conclude that the Coordinating Council should be included in comprehensive statewide manpower planning and should play a central role in such planning.

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SECTION VI

MAJOR ISSUES IN EDUCATIONAL PLANNING

This section is a review of six major issues in educational planning. The issues have been selected for discussion as a result of our studies of manpower supply and demand in selected occupations. We have already discussed some of these issues in section III, dealing with methodological problems in supply and demand studies. Here they are discussed, along with additional issues, in the context of educational planning. The six issues are: (1) individual student choice versus state or institutional control of educational programs; (2) responsiveness of students and educational institutions of job-market demand; (3) job-market demand and social needs; (4) limitation of enrollment versus other manpower adjustment methods; (5) non-system versus system in education and educational planning; and (6) short-range versus long-range educational planning.

Individual Student Choice vs. State or Institutional Control of Educational Programs

There are two conflicting viewpoints about the relationship among individual students, educational programs, and the job-market. According to one view, the choice of an educational program, the selection of a college degree to achieve, and the pursuit of a particular career should be matters of individual choice. This viewpoint has its roots deep in the American tradition of individual freedom and the freeplay of market forces. In addition to democratic and capitalistic influences, this orientation also has a pragmatic foundation. Seymour L. Wolfbein stated the rationale for it when he wrote, "the function of education can be viewed as the process which enables an individual to withstand the inevitable changes which will occur in the relationship between what he learns and what he will be called upon to do in the world of work."[1] Wolfbein's thesis, which he shares with many others, is that the individual and his or her interests, motivations, aptitudes, and talents are the key factors in the relationship between higher education and the manpower requirements of the economy. From this point of view, manpower surpluses or shortages are solved not by government action, but by the operation of individual initiative and mobility and by the decisions of educational institutions, acting independently, to create new programs or to curtail or abolish old ones.

Some experts in the field of manpower supply and demand studies also support the individual choice thesis. Their viewpoint, however, is based not on philosophical grounds but on the practical conclusion that manpower planning is too unreliable and ineffective to be used as a basis for determining what educational careers students should pursue. Some of the more common manpower planning deficiencies that they identify are: (1) a high rate of error in predicting changes in occupational needs; (2) imprecise knowledge about manpower adjustment mechanisms; (3) decentralized decision-making power and planning with respect to manpower flow which is therefore ineffective; and (4) lack of knowledge about how to influence student career choices. In light of these deficiencies, the question is asked if it makes sense to attempt manpower planning. Some manpower experts answer this question in the negative, asserting that our lack of data and our ignorance are

so great in this field that "any planned intervention is about as likely to have an unwanted outcome as a result that was intended."[2]

Those who support the individual choice point of view suggest a number of ways to deal with manpower supply and demand imbalances when they occur. One major course of action is in the content of education itself. Educational curricula should be designed to make the individual flexible and adaptable so that he has the ability to make wise career choices when necessity requires it. Another solution is to provide continuing education so that the individual can learn new skills if changing job markets require them. In addition, over-specialization should be avoided so that individuals are not permanently trapped with obsolete skills. Some have suggested that the responsibility for highly specialized training should rest with employers rather than educational institutions.

The opposing point of view is that both state and federal governments have the responsibility to ensure that students are educated for identified jobs in the economy. This point of view begins with recognition of the fact that the taxpayers support institutions of public education. These educational institutions are, therefore, the servants of the state. Their function is, then, to provide an educated and trained manpower supply that meets the needs of the state economy. From this perspective, if a manpower shortage exists, it is the responsibility of the state to financially support educational programs or individual students until the shortage is eliminated. Similarly, if there is a surplus, as is now the case in some occupations in California, the state should withdraw financial support from either educational institutions, or students, or both, until the surplus disappears. A state governor expressed this viewpoint at a national conference on manpower planning.[3] He suggested that a manpower program should take these steps in sequence: (1) examine the economy to see what jobs require manpower; (2) establish educational and training programs to create the needed skills; and (3) identify those individuals in the community that are willing and have the capacity to absorb the education and training. This kind of approach has also been advocated by officials of the U.S. Office of Education and the Governor of California in the form of "career education."

There can be no argument with the proposition that the culturally disadvantaged and the poor need to be trained in marketable skills. Similarly, high school dropouts and graduates not intending to go on to college should receive training that will help them find jobs. The real issue is how high up the educational ladder, and in what branches of higher education, this concept of "career education" can be applied effectively. In a period of manpower surpluses, the concept of channeling students into educational programs that meet job-market demands appears reasonable. For those situations where young people need jobs and where a job-market exists, career education is an excellent objective for education. The problem is defining all those situations where the career objectives of students are unknown or in an exploratory stage, and situations in which the job-market is unknown or changing. In a dynamic and changing society such as ours,

based as it is on science and technology, it is difficult to see how the concept of career education can be applied across broad areas of the current educational scene. As E. Wight Bakke notes, "one of the strengths of our system has been a tradition of loose coupling between specialization in undergraduate or graduate school and a man's field of employment."[4]

Career education implies that career fields can be identified in advance, that educational programs can be developed to meet the career needs identified, and that students will then elect to study for those career fields. This approach implies an omniscience on the part of educational planners that does not exist. Our studies of manpower supply and demand in selected occupations indicate that at the present time systematic manpower planning in California and the data required to perform effective statewide planning do not exist. Neither educational institutions nor state agencies can anticipate job-market demand with any reliability. And student interests in such areas as law, social work, and fine arts have little relationship to the job-market.

We do not believe this issue of individual student choice versus state or institutional control of educational programs can be resolved in a rational manner without some consensus on the objectives of education. Since there are many levels of education and many different types of educational programs geared to the needs of different segments of the population, a systematic approach is essential to the definition of these objectives. As in business management, a "heirarchy of objectives" is required. There is a place for individual student choice and a place for career education guided by the state in the educational scheme of things. But it is unlikely that there can be a rational solution to oscillating manpower shortages and surpluses in the absence of a national long-range manpower policy, a state-level long-range manpower policy, and the expansion of the present responsibilities of the statewide educational planning body to include the necessary authority to give higher education in California a clear sense of purpose and direction.

We can appreciate the concern of elected officials for the apparent waste of the taxpayer's money when public educational institutions produce too many teachers, engineers, and chemists at a given period of time. But we must also call attention to the fact that "the cost to the economy of an inadequate supply of educated persons is probably greater than the expenditure of resources involved in creation of an excess of graduates beyond the needs of the economy...."[5] Educational programs that are not needed should not be allowed to continue indefinitely. But it would be unfortunate for California if decisions to eliminate or curtail educational programs were taken without the thorough study and long-range planning such decisions require. As we have noted, the consequences of action may be different than what was intended.

Responsiveness of Students and Educational Institutions to Job-Market Demand

Educational institutions have been criticized for not being responsive to the manpower needs of the economy and for being too responsive. In a comparison of higher education in Britain and the United States, Hugh Folk found that American colleges and universities were much more responsive to the needs of students and employers than their British counterparts.[6] And, he writes, "with few exceptions, failure of American institutions to meet needs results from the unwillingness of students to enter training in the needed occupations...."[7]

Lewis B. Mayhew, in his study of graduate and professional education has pointed out the "developing" educational institutions, such as the large state universities, are more responsive to external forces than the "developed" educational institutions, such as Harvard, Yale, and Princeton. The latter institutions "frequently appear somewhat impervious to community needs. They expect growth to be motivated internally as a result of faculty interests and the expansion of scholarly disciplines...."[8] By contrast, the developing institutions tend to view manpower needs in much more immediate terms, such as meeting the occupational requirements of specific industries.[9]

Mayhew describes the growth of graduate and professional education in the United States after World War II. He writes:[10]

> This was the cold-war period of the creation of the National Science Foundation (1950), Sputnik, the National Defense Education Act, the expansion of Department of Defense supported basic research, and NASA-sponsored space exploration. It was a period when Congress appropriated even more funds than medical research could use wisely. With such demand and such largess, higher education responded predictably.
>
> Established graduate schools expanded enrollments several hundred percent, and lesser institutions aspired, and not infrequently conspired, to obtain funds for new medical schools, more research, and a chance to become regional centers of excellence. States, by the 1960's, had begun to devise master plans to ensure that resources would serve the people's demands for universal higher education and at the same time produce the research essential for a healthy economy.

The U.S. Department of Labor also notes that during the 1960's universities were encouraged to expand their efforts in basic research with contracts from NASA, NSF, and the Departments of Defense and Health Education, and Welfare.[11] These contracts carried funds for the "education, training, and employment of additional large

numbers of young people."[12] However, the Department of Labor goes on to point out that the funding provided by the Federal government and the responsiveness of the universities "contributed greatly to the disorganization of the professional labor market after the Government changed tack. Young scientists continued to come out of the pipeline in large numbers at the same time that others were losing their jobs."[13]

Thus, if educational institutions are to be criticized, their fault would appear to be that they were too responsive, rather than not responsive enough, to the needs of the community as identified by the Federal government. The issue of the responsiveness of educational institutions to manpower requirements of the community is complicated by the internal dynamics of these institutions. It is this aspect of institutional behavior which may account for the view held by some people that educational institutions are not responsive. Mayhew, for example, describes the dynamics whereby newly created institutions seek to build new doctoral and professional programs not because of any clearly perceived job-market demand, but because of the ambitions of faculties and college and university presidents to achieve the status and prestige of the more senior universities.[14] It is this internally generated pressure for growth in the developing institutions that has serious implications for higher education in California.

Mayhew points out that in California the pressure for growth in doctoral and professional programs in the developing institutions brings them into conflict with statewide coordinating agencies. He writes that such coordinating agencies[15]

> have been created to achieve a better, more economical deployment of state resources for higher education and to prevent unnecessary duplication of high-cost programs....But once an institution is struck by the virus of graduate and advanced professional work, it will oppose efforts to contain its ambitions, whether these be made by the state's senior institutions or by a coordinating body.

If Mayhew's analysis is correct, there is a need in California for the Coordinating Council for Higher Education to ensure that new educational programs do not proliferate because of the "virus" of graduate and professional programs.

Our study of supply and demand in selected occupations indicates a mixed picture insofar as student responsiveness to job market demand is concerned. Enrollment is down in engineering and teaching. This appears to reflect student responsiveness to the poor job prospects in these fields. However, the decline in enrollment in engineering predates the recent tightening of the job-market in this field. The National Science Foundation reports in one of its publications, for example, "that the decline of interest in science

and engineering at the graduate level preceded recent reductions in Federal support of graduate training."[16] This suggests that the loss of student interest in engineering may be more than just a response to the job-market. It may reflect the more general attitude of negativism toward science and technology that appears to be widespread among young people today. The decline of enrollment in teaching does appear to be a response to the unemployment situation in that field.

The relationship between supply and demand in the other fields studied - chemistry, law, social work, and the fine arts - appears to reflect student interests which are not related clearly to the job-market. The only exception to this may be chemistry. Rising enrollment in chemistry may reflect a pragmatic decision on the part of many students to prepare for occupations in the health professions where job prospects are good. But they may also be interested in social problems related to environmental pollution and ecology. In the remaining fields, law, social work, and the fine arts, the students are not responding to job-market conditions. Law may involve response to the job market to some extent. In the case of fine arts this is not a new phenomenon. Traditionally, unemployment in this field has been high but it has not deterred students from seeking degrees in the field. The sudden increase in enrollment in law and social work, despite the lack of evidence of a job-market in these fields, suggests that students may be responding to such values as the desire to work with people and to resort to the law as a way to ameliorate social problems of various kinds, as exemplified by "Nader's Raiders."

Our review of selected occupations clearly shows that California institutions of higher education are responsive to student interests within constraints imposed by existing student spaces, available faculty, and related resources. In chemistry, for example, both the University of California at Berkeley and Stanford University have doubled their freshman enrollment over a two-year period in response to student interest in this area. In law, educational institutions are doing everything they can to accommodate the startling growth of student interest in this profession. In such fields as social work and fine arts, the educational institutions accept all qualified students who apply. Both in our literature review and in our studies of supply and demand in selected occupations for this report, we have found that within those constraints identified by Mayhew, educational institutions in California are responsive to community pressures and to student interests.

Two comments need to be made about this situation. One is that the Coordinating Council for Higher Education, as the designated statewide planning agency needs to have authority to control the orderly growth of those "developing" institutions which may be responding primarily to internal pressures, rather than community job-market demand; and, secondly, the long-range objectives of each level and type of educational institution in the statewide structure of higher education needs clarification and definition.

In the absence of clear objectives, there is always the danger that educational institutions may be too responsive to external pressures, as they were during the 1960's when the availability of Federal funds apparently proved to be irresistible. An independent state agency such as the Coordinating Council needs to have the authority to prevent individual state educational institutions from altering their functions and growth plans within the overall state structure due to the lure of funds provided from outside the state.

Job-Market Demand and Social Needs

One of the most difficult problems we have found in attempting to project job-market demand for educated manpower into the future is the problem of differentiating between job demand and social needs. In our studies of manpower supply and demand for chemistry, law, social work, and teaching, for example, we found that the consideration of social needs as distinct from job-market demand made a major difference in estimates of possible manpower surpluses.

The difference between these two concepts is made clear by the Staff Report of the Commission on Human Resources and Advanced Education. The Report states:[17]

> Demand is used in the economic sense, and refers to the existence of positions and funds to employ persons. Need is used in the social sense of the number of people that would be required to meet some social goal. Need may be larger than demand, or smaller.

We are critical in our studies of specific occupations in this report of projections of job-market demand made by the U.S. Department of Labor, the California Department of Human Resources Development, and some independent researchers because their demand estimates for the future are based on the types of employment known in the past. This basic assumption leaves out of consideration those possible jobs and occupations that may appear as a result of technological breakthroughs (the occupations of programmers and system analysts are excellent examples) and those that may appear in response to changing conceptions at Federal and state levels of social needs. Once funding is provided by these government sources, any social need may be transformed into economic demand.

The concept of social needs has serious implications for attempts at educational planning, especially in a state such as California which has been heavily dependent for employment on Federal spending for R & D, aerospace, and defense. If, for example, a state agency, one of the segments of higher education, or an individual college or university should limit enrollment in educational programs on the basis of projections of economic demand, manpower shortages may occur in the future if social needs are transformed into jobs. The classic example of this phenomenon is the statement of President John F. Kennedy that the United States would put a man on the moon by the end of the 1960-70 decade. The translation of this social

need, as perceived by the Kennedy Administration, into job-market demand created employment for thousands of engineers, scientists, and technicians in California.

As we write this report, the United States Senate has just passed a $2.95 billion child-development bill designed to fund the biggest program of federally backed day-care centers in history.[18] Sponsors of the bill claim it would fund facilities for 700,000 children in its first year of operation, double the number now available. If we assume that such day-care centers would require one employee for every 20 children, that would create a demand for 35,000 employees, not counting supervisors or administrative personnel. These employees might come from the ranks of currently unemployed teachers. Thus any estimate of a surplus of elementary teachers, including ours in this report, would be transformed into a shortage if the Senate bill were approved by the House of Representatives and the President.

Whether the children's day-care bill becomes law or not (it is expected to be vetoed by President Nixon), it illustrates the dilemma that educational planners must face. And if this bill should fail, there are others right behind it with equally serious implications for future employment. The U. S. House of Representatives, for example, is pressing ahead with a bill that would provide $5.3 billion each year for aid to the states and cities.[19] Governors, mayors, and other local officials are lobbying to push the bill through the House. We cannot estimate how many jobs this bill might create if it became law or what kinds of occupations would be affected. We can say that it would affect job demand projections based on past employment patterns.

The Commission on Human Resources and Advanced Education, using the estimated need for college graduates derived from projections developed by Leonard A. Lecht for the National Goals Project, concluded that the number of male college graduates required to meet the projected social need in such areas as health, education, transportation, housing, and other areas by 1975 is 1.5 to 2 million more than the number of male college graduates who will graduate by that time.[20] The equivalent number for women college graduates is 500,000 to 800,000 more than are expected to enter the labor force by 1975.

Estimates of future job demand are, therefore, unreliable at best. This is not to say that they should not be made. But it is evident that any educational planning activity cannot afford to ignore the possible impact of social needs on its plans. As we approach the national elections of 1972, job demand for the 1970-80 decade may be very different from anything now anticipated depending upon which political party emerges as the winner.

Reduction of Enrollment vs. Other Manpower Adjustment Methods

There are many different ways in which adjustments to manpower surpluses and shortages can be made in various occupations. Educational planners should be familiar with all of the methods described below and be able to utilize them depending upon the occupations

involved and economic and other circumstances. Unfortunately, one of the least desirable methods of correcting manpower imbalances appears to be the one most commonly used, that is, the curtailment or elimination of educational programs when surpluses occur. Similarly, when there is a manpower shortage, the usual method is to enlarge educational programs or to create new ones.

The Commission on Human Resources and Advanced Education, reviewing this issue during a period of manpower shortages, states that "it is ironic that in our attempts to alleviate manpower shortages, we have devoted so much attention to expanding the flow of persons through the education system and attracting people into high-demand occupations, because these are among the slowest and in many ways least effective methods for relieving manpower shortages."[21] Since the time required to expand educational programs is lengthy - up to ten or twelve years in a field like medicine - the demand may not be satisfied when it occurs. And once educational programs are established, there is then the problem of shutting off the supply before the shortages turn into surpluses. A major task of statewide educational planners should be to take actions that would avoid such oscillations in manpower conditions. The effects of such oscillations on students, faculty, and educational administrators can only be negative, if not traumatic.

The expansion or contraction of educational programs and enrollment opportunities by administrative fiat is not consistent with the fundamental democratic right of students to select their own career paths through the educational system. In our studies of selected occupations for this report, we found that students are not always responsive to job-market demand and are attracted in some cases to educational programs for reasons that are difficult to identify. High enrollment in such fields of study as law, chemistry, social work, and the fine arts are examples of this. Thus, closing down enrollment opportunities in low job demand fields does not ensure that students will then enroll in fields where demand is high. Not every student wants to become a doctor or a nurse.

During the 1950's and 1960's when the demand for college educated manpower was high, educational programs were expanded in almost all areas. The more difficult educational planning task of identifying those specific programs that needed to be expanded was neglected.[22] In their review of state master plans for higher education, Folger, Astin, and Bayer state that such plans consider manpower needs "chiefly as a justification for planned expansion rather than as a basis for estimating the kinds and the extent of the educational programs that will be required."[23]

An important method of correcting imbalances in manpower supply and demand is the labor reserve, although this source of available manpower has received relatively little attention. Folger, Astin, and Bayer report, for example, that from 1950 to 1965 the annual reports on supply and demand for teachers made by the National Education Association "made no effort to identify the magnitude of or flow into and out of the labor reserve."[24] Yet such fields as teaching and

social work, which are reviewed in this report, have relied heavily in the past on women in the labor reserve when there were manpower shortages. No data were available to us, however, on the relationship between possible surpluses in these fields and the labor reserve. An estimated surplus in a field that largely employs women may always be higher than estimated if the labor reserve is not taken into account since older women may want to return to work after a period of absence.

The use of educated women who are qualified to work in an occupation but who are not currently employed is one of the fastest ways to increase the worker supply. This is a much faster method than increasing college enrollment in that occupation. In the past, when demand was low, more women remained in the labor reserve. Today, with a possible period of low demand ahead for the 1970's, the labor reserve may fail to absorb potential female workers because so many more women appear to be planning to enter the job market, postponing marriage, and having fewer children. Nevertheless, the labor reserve is a manpower adjustment method that educational planners should always bear in mind.

Another method of adjustment when there are imbalances in manpower supply and demand is changing the age of retirement. This method has been used during periods of high demand, especially in professions such as law, medicine, teaching, and engineering. During a period of surplus, reducing the age of retirement could be used effectively. Especially in education where the number of surplus teachers may be critically high for a number of years, early retirement could be made mandatory at the age of 60, or possibly 55. This method of dealing with a surplus would be much less damaging to the quality of educational institutions and less damaging to the career plans of student-teachers already in the educational pipeline than closing down teacher-training programs which some colleges are already doing. (See our section on teacher supply and demand.)

A commonly used method of manpower adjustment in the 1950's and 1960's was the lowering of standards or qualifications for job entry in such fields as teaching and engineering. The hiring of teachers without teaching credentials or college degrees has been used in many states as a way of filling open teaching positions. In California during the years of expansion in the aerospace and defense industries, many persons found employment as "engineers" who did not possess college degrees.

A period of manpower surplus provides the opportunity to raise educational standards for job entry and to improve job qualifications. Rather than regarding the present manpower surplus in education as a disaster, educational planners in California have the opportunity to raise the qualifications for teachers at all levels where it may be advantageous to do so. In addition, teacher-student ratios can be reduced and teachers can be found to provide education for pre-school children, particularly among the culturally disadvantaged. Thus, a period of manpower surplus provides educational planners with alternatives. One alternative is to reduce enrollment. This may appear

to be financially desirable but, as we have noted, this method may only lead to another round of manpower shortages in the future. In addition, it introduces tensions in educational institutions which lower morale and the quality of education. The second alternative, which is also costly but we believe more desirable in the long run, is to raise the quality of education wherever possible.

One of the least well-understood methods of adjusting imbalances in supply and demand is the mobility of the work force, both geographically and occupationally. Yet this method is probably one of the most commonly used when imbalances occur, and it is the most effective for short-run fluctuations in supply and demand. Every reader of this report should ask himself where he received his education and where he now works; and he should also ask himself how many different occupations he has had since he graduated from school, as well as how many he had before or during the time he went to school. Changing jobs and careers is a commonplace phenomenon of American life.

California benefitted greatly in the decades of the 1950's and 1960's from the geographical mobility of people who migrated into the State seeking work when job demand in the State was high. The education of these people cost the State nothing. Out-migration of many highly educated persons who received their education in California may now be occurring at great cost to the State. Educational planners must have data on the depth and range of these in-migration and out-migration phenomena. It is difficult to see how the true costs of education can be determined without such information. Notions of the "sunk-costs" of teacher training in California, for example, should discount the costs saved by the State as a result of teachers who have migrated into California.

While California has had the benefit of in-migration of highly educated workers in the past, this may not be the case in the future as the in-migration rate declines. One of the tasks of educational planners in this situation, it seems to us, would be to facilitate occupational mobility. This should begin with students while they are still in college and continue after they have entered the job-market. It can be accomplished by making the standards, qualifications, and procedures that currently impede the flow of students within the educational system and the movement of workers outside the educational system who may want to return to it for refresher courses and training in new careers much more flexible than they now are. Bureaucratic rigidity with respect to entrance requirements, prerequisites for courses, and all the other traditional impediments to the freer flow of students and non-students alike should be carefully examined by educational planners at the state level. Thus when surpluses appear in given fields, the system itself should facilitate career changes and occupational mobility, rather than preventing such changes and mobility as is now too often the case.

Non-System vs. System in Education and Educational Planning

The Master Plan for Higher Education in California has been lauded for its creation of a model educational system and as a model for

statewide educational planning. But as we point out in Section IV of this report, much depends on how you define a "system". In our examination of the structure of higher education in California, including the relationship of this structure to students and to the job-market, we concluded that there was (1) no system of education in the State in any meaningful, technical sense (as system analysts would define a system), and (2) no adequate management information system to plan for, monitor, and evaluate the performance of the educational institutions and segments. While the Coordinating Council for Higher Education presently has some limited planning responsibilities, it is primarily a coordinating and advisory body without the authority or the means required for system planning, monitoring, and evaluation.

There can be no system of higher education as long as basic questions about educational objectives remain unresolved. For example, it is not clear whether the function of educational institutions is to educate in the broadest sense of the term or to provide a supply of graduates for the job-market. Recent criticisms of higher education and calls for "career education" imply that serving the job-market is a primary objective. It is not clear whether students should be allowed to enter any career field of their choice or if enrollment in specific fields should be controlled by educational institutions or by the State through its funding powers. The proper role of a statewide planning agency with respect to these questions about the objectives of a system of higher education is not clear.

In industry, government agencies, and in military organizations true systems, as defined in section IV, can be created because of a highly centralized organizational structure. The objectives of the organization can be clearly defined because there is a central authority with the power to define them. Such problems as the specification of system performance requirements, the design of subsystems and their interrelationships, the standardization of data elements, and the creation of feedback mechanisms can all be resolved, given a centralized authority structure.

These conditions do not exist in higher education in California and it is doubtful if anyone would want such a centralized structure in the field of education. The issue can be stated this way: is it desirable for California to have a more centralized educational structure in order to improve the planning process or does it wish to continue to have no agency below the level of the Governor and the Legislature with the authority to reallocate resources among the segments on the basis of changes in statewide needs and objectives?

In our opinion, based on experience in the systems field and in education, statewide educational planning cannot be made more effective or more rational without a larger degree of centralized authority than currently exists. The problems we encountered in conducting data collection activities for this report strongly support this conclusion. Many improvements in administration and recording procedures are possible, especially in the area of creating standardized data elements. Such

improvements can be undertaken without in any way jeopardizing the current operational independence of the private and public segments comprising the higher educational structure of the State.

Time, however, is a critical factor since independent computerized management information systems are being created by several of the segments. If these independent developments are permitted to continue without the specification of statewide planning requirements for these systems by an agency representing the State, statewide planning will be more difficult to achieve in the future than it is now. And in the long-run, the task of achieving statewide systems integration will be more costly.

Short-Range vs. Long-Range Educational Planning

As we have seen in this report, there are manpower experts who question the value of any educational planning for correcting imbalances in manpower supply and demand. We have also found that projections of manpower imbalances have a high degree of unreliability. One of the most thorough and intensive manpower supply and demand studies we have seen, published as recently as 1970, incorrectly predicted continuing shortages of engineers for the 1970's.[25]

We believe there is a very important issue involved here which scholars are just beginning to address. This is the relative value of short-range versus long-range forecasting. For the purposes of this discussion, we shall arbitrarily define "short-range" as 20 years or less and "long-range" as more than 20 years. By these definitions, most of the manpower studies we have seen for this report deal with the short-range. Many studies deal with a period of only five to ten years. The most commonly used time-span is ten years, no doubt due to the use of data from the decennial census.

It is generally believed that short-range forecasts are more reliable than long-range forecasts, since it is assumed that events and conditions closest to us in time are more predictable than those more remote in time. Thus, millions of dollars are spent each year on weather forecasting, although such forecasting is frequently wrong. Our society spends large sums of money attempting to predict short-run trends in the stock market, wholesale and retail prices, savings, investment, and employment. But these short-range predictions, as we have seen in this report with respect to imbalances in manpower supply and demand, are frequently incorrect due to frequent fluctuations in the economy and in government spending. There is good reason to believe that the basic assumption is not correct; that, in fact, if we look in the right areas, long-range forecasts may be more reliable than short-range forecasts for the purposes of educational planning.

Manpower experts are correct who state that forecasts of manpower supply and demand imbalances are unreliable and that the results of educational planning are, therefore, frequently different than the planners intended. But they are right because education planning and the manpower studies and forecasts it is based on only cover a short-range time span. Within that time span, imbalances of supply and

demand fluctuate wildly If we enlarge the time span of educational planning, however, it may be possible to reduce the fluctuations. The U. S. Department of Labor rightly, we believe, cautions educational planners against overreacting to current manpower surpluses. In the *Manpower Report of the President*, the Department of Labor stresses the "longer view" in assessing the job demand for highly educated professionals such as engineers and scientists.[26] Educational planning needs to consider short-range problems, but they should be analyzed within a context of long-range sociocultural, scientific, and technological trends.

The use of long-range trends for educational planning is not as strange as it may first appear. Historians, sociologists, philosophers, and anthropologists have frequently dealt with social processes that occur over periods of hundreds of years. Social trends that have persisted over 500 years have been described in the work of such scholars as F.S.C. Northrop, Arnold Toynbee, Alfred L. Kroeber, Ralph Linton, Julian Steward, Pitirim Sorokin, and many others. The following list of long-range trends suggests the types of trends we believe should be closely looked at by educational planners:

1. Population growth
2. Industrialization, including the emergence of the "Postindustrial" society
3. Urbanization (particularly the increasing concentration of Negroes in the central cities)
4. Increasing growth of knowledge, science and technology
5. Increasing democratization, egalitarianism, and meritocracy
6. Increasing growth in the scale of organization with bureaucratic characteristics
7. Increasing economic affluence
8. Increasing professionalization
9. Increasing specialization
10. Increasing automation of production and information flow
11. Increasing centralization of control
12. Increasing amount of leisure time
13. The advance of feminism
14. Increasing reduction of all personal economic risks
15. Increasing tempo of change

All of the trends listed above have lasted for hundreds of years and most of them will probably continue for hundreds of more years.[27] It would seem essential to us that educational planning should broaden its scope to include such long-range trends in its analyses of manpower supply and demand and in determining the relationship between enrollment and educational programs.

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SECTION VII

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Manpower Data Collection

1. The most serious problem encountered in this study was obtaining data from California sources on enrollments and degrees awarded for the academic years 1967-68 to 1971-72 in the six selected occupations - engineering, chemistry, law, teaching, social work, and the fine arts.

2. The major source document used for estimating job demand from 1968 to 1975, *California Manpower Needs to 1975*, published by the California Department of Human Resources Development, was unreliable because it was based on assumptions of continuing economic growth and industrial expansion which were negated, especially in California, by reductions in Federal expenditures and the economic recession of 1969-71.

3. Data from different sources on such important variables as enrollments, degrees awarded, and occupational titles are not standardized so that they are difficult to use for estimating supply and demand relationships.

Methodological Problems in Supply and Demand Studies

1. The results obtained in typical manpower supply and demand studies were found to be highly unreliable in our literature review because they were based on overly simplistic assumptions, e.g., using past employment structure and trends as a basis for estimating future job-market demand.

2. A major gap in available data for this report was the lack of information about student objectives, motivations, and values. Hence we could only speculate about why students are showing great interest in fields where current job-market demand does not exist.

3. Large fluctuations in manpower surpluses and shortages in occupational fields such as engineering, chemistry, teaching, and social work within relatively short periods of time appear to be directly related to Federal and State funding policies.

4. The potential supply of women in the labor force is expected to grow rapidly as a result of the current "women's liberation movement." This could cause larger surpluses than anticipated in those occupations where women have predominated, e.g., teaching and social work.

A Systems Approach to Educational Planning

1. Higher education in California is not a system in any meaningful, technical sense (as the term is used by system analysts), nor does the Coordinating Council for Higher Education have access to an adequate management information system to facilitate its planning and coordination functions for higher education in California.

2. The current development of independent and unintegrated computerized management information systems by various educational institutions and segments of higher education will make statewide educational planning more difficult in the future and will increase the cost of ultimately creating a statewide system.

Supply and Demand in Selected Occupations

Engineering

1. There is and will continue to be a surplus of engineers in California, at least through 1975.

2. The apparent surplus of engineers in California as indicated by the relatively high rate of unemployment in the State compared with the national unemployment rate is attributed to the decline in Federal funding for work in aerospace, defense, and R & D, and not to a lack of responsiveness on the part of educational institutions.

3. The surplus of engineers may not persist beyond 1975 because of declining enrollment in this profession and possible increases in Federal spending related to industries that employ engineers.

4. The fluctuations in shortages and surpluses in engineering may be best described as a "roller coaster" ride brought about by the absence of a national manpower policy, random increases and decreases in Federal expenditures, and the readiness of educational institutions to respond to Federal funding for research and student support.

5. The field of engineering is characterized by overreactions by both students and government officials to short-range fluctuations in supply and demand.

Chemistry

1. Despite evidence of unemployment in this field and a declining job demand for chemistry teachers, students are enrolling in freshman chemistry courses in record numbers.

2. If the current upward enrollment trend continues, there could be a serious surplus of chemists until 1975 and an increasing surplus beyond that date.

3. The lack of information about student interests and career objectives makes it impossible to determine why enrollment is rising in chemistry while job demand is declining. We can only speculate that students are preparing to enter the health professions in recognition of the employment opportunities in those fields.

4. Since the future job-market for chemists cannot be ascertained, the objective of educational programs in this field should be flexibility, generality, and an avoidance of excessive specialization.

5. Academic programs in chemistry should shift their emphasis from preparation for employment in academia to applied research in industry.

6. Changes in the content of higher-level chemistry educational programs may be more essential than changes in the numbers of students who are graduated.

Law

1. Student interest in law, both nationally and in California, has been growing at an unprecedented rate and qualified applicants are being refused admittance to California law schools in record numbers.

2. If present national enrollment trends continue, the law profession will approximately double its size by 1985.

3. If current trends in the production of lawyers in California continue, there will be a surplus of lawyers by 1975.

4. There may be a still larger surplus of lawyers beyond 1980 unless existing social needs for legal services are translated into job demand by the Federal or State government.

5. There would not be a surplus of lawyers during the 1970-80 decade if social need, rather than job demand, were used as a basis for estimating possible manpower imbalances.

6. It would appear to be unwise to create new law educational facilities in California at the present time in light of the low current and projected job demand for lawyers.

Teaching

1. Only crude estimates of future manpower imbalances are possible in this field because of the unavailability of current and reliable data on teacher supply and demand.

2. Based on available data from various State and national sources, there is a current surplus of elementary and secondary teachers in California and it is expected to continue through the 1970-80 decade.

3. Due to rapidly declining enrollment of elementary school-age children in California during 1970-80, the main source of demand for new teachers in the elementary school will be replacement requirements for teachers who retire, die, resign, or otherwise leave the profession.

4. In view of the large numbers of prospective teachers involved and the serious nature of current and estimated teacher surpluses in California, planning for elementary and secondary school teachers is one of the most pressing problems for educational planners in the 1970's.

5. The surplus of teachers will constitute a major problem for women since teaching is by far the largest source of professional employment for them and the surplus is occurring at a time when more women than ever before are seeking professional employment.

6. The surplus of highly qualified teachers provides the State of California with a rare opportunity to improve the quality of education.

7. If limiting enrollment of students in teacher preparation institutions is adopted as a method of coping with existing and projected surpluses of teachers, we believe that great care should be used in implementing such a policy to ensure that highly qualified student prospects are not denied the opportunity to pursue teaching careers.

8. The failure of agencies responsible for projecting teacher manpower supply and demand and their predictions of shortages of teachers until recently indicates that current forecasting methodology is unreliable and that educational planners should use such sources of data with great caution.

Social Work

1. The current surplus of social workers will increase sharply in 1973-74 and become still larger in 1974-75 because of rising enrollment in conjunction with cutbacks in financial support of social welfare programs.

2. Social work is a field in which students are showing increasing interest, apparently because it is a field in which one works with people rather than with "things."

3. The supply of entrants into social work is difficult to estimate with reliability based on enrollment or degree data because so many graduates enter the field with degrees from other fields such as the humanities, social sciences, and teaching.

4. The close relationship between job demand in social work with social needs as defined by Federal and state government makes it difficult to estimate future job demand with any reliability.

5. Since past demand in social work is an unreliable basis for estimating future demand, we conclude that a policy of limiting enrollment in order to reduce current surpluses should only be used with extreme caution. Allowing individual choice to remain the basis for enrollment is highly desirable.

Fine Arts

1. It is difficult to compare supply and demand in the fine arts since there is no common agreement on the definition of the supply and demand categories. For example, the U. S. Department of Labor, unlike the University of California, aggregates athletes and entertainers with artists in its estimates of job demand.

2. The supply of people in the fine arts is difficult to estimate because a degree is not required to work in the field and many employed in it have degrees from unrelated fields.

3. If present trends in enrollment and degrees awarded continue, a large surplus of fine arts graduates is expected by 1975 and a still larger surplus beyond that date.

4. Data on enrollment and degrees awarded in the fine arts indicate a growing interest by students in this field despite the fact that it is historically slow growing, underpaid, and characterized by unemployment twice as large as other fields.

5. The fact that student interest in the fine arts appears to be unrelated to job-market considerations suggests that individual choice should prevail as the basis for enrollment despite the existence of manpower surpluses rather than limiting enrollment by educational institutions.

Other Manpower Development Programs

1. A framework for manpower planning and development already exists within the State. Various agencies and programs are involved with a number of manpower training programs that are designed to provide employment or reduce unemployment in various areas of the State.

2. However, an overall manpower policy does not exist in the State. As a result, the various manpower programs we have examined appear to be fragmented, lacking in coordination, and overlapping in their direction and focus. Little communication and coordination were observed among State manpower agencies and some competition was noted.

3. The major thrust of the State's manpower planning and development efforts is devoted to serving the disadvantaged. We were unable to identify any operational programs, agency, legislation, or financial support that are specifically addressed to the problems of college educated manpower in the State. The employment problems of the disadvantaged are most worthwhile and of great importance to the State. However, a comprehensive manpower policy and development program for California must focus on the employment problems of individuals at all levels of occupational structure, including college educated manpower.

4. There is no provision in the State's comprehensive manpower plan, or in any of its manpower development programs, for direct involvement of the Coordinating Council for Higher Education, the designated agency for coordination and planning of higher education in the State. The Coordinating Council should be included in comprehensive statewide manpower planning and should play a central role in planning for college educated manpower.

RECOMMENDATIONS

1. In cooperation with the segments, the Coordinating Council for Higher Education (CCHE) should assume a leadership role in the identification of long-range objectives for the statewide system of higher education in California.

2. The Coordinating Council should request the California Legislature to assign it the responsibility for developing the specifications for a statewide, computerized management information system to facilitate statewide planning for the orderly growth of higher education.

3. An information requirements analysis study should be sponsored by the Coordinating Council and undertaken in cooperation with the segments. The study should result in

the design and development of a standardized data base containing comparable student enrollment and degree data by academic disciplines and fields of study as the first phase of the design of a statewide, computerized management information system for planning purposes.

4. In order to ensure inter-system integration and compatibility, the Coordinating Council should be designated as the responsible State agency by the California Legislature for reviewing plans for computerized management information systems now being designed and developed independently by public higher education segments in the State.

5. The Coordinating Council should establish a staff function within the Staff Organization of the Council with the responsibility to conduct manpower supply and demand studies as needed, and to disseminate the results of such studies to all public and private institutions in the State for planning purposes.

6. The Coordinating Council should sponsor a national conference consisting of other state coordinating councils for higher education, the U. S. Department of Health, Education, and Welfare, Office of Education, the American Council on Education, the U. S. Department of Labor, other Federal and state educational agencies, professional associations, representatives of higher education and government manpower agencies. The purpose of the conference should be to develop a comprehensive national manpower policy for college educated manpower. This manpower policy, once developed, should be recommended to the Federal government as one step in the elimination of the "roller coaster" effect of government spending on college educated manpower supply and demand.

7. The Coordinating Council should request the California Legislature to prepare appropriate legislation for the development of a comprehensive manpower policy and a comprehensive manpower plan for the State that includes provisions for college educated manpower. The legislation should also provide a central role for the Coordinating Council as the State agency for college educated manpower planning.

8. The Coordinating Council's responsibilities should be broadened to include the responsibility to review annually and comment to the Legislature on the academic plans and programs of the public segments of higher education in California. This review should encompass only those plans and programs that involve responses to Federal funding policies or are in conflict with statewide objectives for higher education in the State.

9. The Coordinating Council should request that a comprehensive, in-depth research study of teacher supply and demand in California through 1985 be immediately authorized and supported by the California State Board of Education. One of the major tasks to be accomplished by this study should be the design of standardized data elements and record keeping by all public and private teacher preparation institutions in the State.

10. The Coordinating Council should conduct a research study of ways and means by which educational quality in public schools throughout the State might be improved at least cost by taking advantage of the unusual opportunity of having a manpower surplus among elementary and secondary school teachers for the first time in decades.

11. In light of known and projected manpower surpluses in the six selected occupations studied for this report, the Coordinating Council should carefully review the possible uses of all known methods of manpower adjustment (described in section VI) before suggesting to the segments that they use the least effective method - enrollment limitations.

12. A research study should be initiated and supported by the Coordinating Council, in cooperation with the segments, of student objectives, motivations, and interests in relation to how career choices are made while enrolled in college. The purpose of the study should be to determine to what extent students have the necessary information about job-markets and how and when they use such information in the process of making career choices.

13. A research study should be initiated and supported by the Coordinating Council, in cooperation with the segments, of methods whereby the segments can encourage students to enroll in educational career paths where known manpower shortages exist or drop out of educational career paths where known manpower surpluses exist and will continue to exist over an extended period of time.

14. An Office of Institutional Research should be established by the California Community Colleges as a staff function, reporting to the Chancellor. The responsibilities and functions of this Office should be similar to those of the Office of Institutional Research Studies, California State University and Colleges, and the Office of Analytical Studies of the University of California.

Working in cooperation with all the community college districts in the State system, major functions of this Office should be the establishment of standardized data elements, in conjunction with the other four-year segments, related to part-time and full-time enrollment, degrees awarded, enrollment in various adult, general, and occupational education programs, transfer data, and other information needed by the Chancellor or Board of Governors for statewide planning purposes.

The Office of Institutional Research of the California Community Colleges should also be responsible for the annual collection and reporting of these types of data to the Board of Governors, the Chancellor, the California Coordinating Council for Higher Education, the state legislature, the other segments of higher education, and other interested groups.

15. The Association of Independent California Colleges and Universities should be encouraged to establish an Office of Institutional Research that is similar in function and responsibility to the Office recommended above for the California Community Colleges. An effort should also be made by the Association to generate interest and support among the 25 non-member institutions in the State to join with the Association in the establishment and support of such an Office.

16. Each of the segments should establish or strengthen existing methods or procedures whereby comprehensive, broad-based job market information and forecasts in a variety of occupations are collected and made available to students on a regular basis. Particularly at the graduate level, as well as the baccalaureate degree level, the segments should ensure that individual institutions implement formal job-market counseling programs before enrollment in a particular field of study, at regular intervals during the program, and prior to completion of the degree requirements.

SECTION VIII

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